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'Alî at-Tabarî's "Paradise of Wisdom", one of the oldest Arabic Compendiums of Medicine

The late Professor E. G. BROWNE of Cambridge, England, one of the most prominent modern orientalists, made us acquainted, in the second of his « Fitzpatrick Lectures » on Arabian Medicine, (1) with one of the oldest treatises on natural philosophy and medicine written in Arabic. This is « The Paradise of Wisdom » *(Firdaws al-Ḥikma)*, a book composed by 'ALÎ IBN SAHL (RABBAN) AṬ-ṬABARÎ, a Persian physician of the IXth century A.D. BROWNE hoped to edit and perhaps translate this treatise in which he took the most lively interest. Unfortunately he died in 1923, before he could prepare more than the first pages of his intended publication. But, happily, one of his pupils, the Indian Arabist MUḤAMMAD ZUBAIR AṢ-ṢIDDÎQÎ had taken part in the task since 1922, when he was sent to Cambridge by the Government of the Indian province Bihar and Orissa as a « Research Scholar ». He could carry on his meritorious work and finish it in 1924 and, with the aid of a subsidy from the E. G. W. Gibb Memorial Trust, edit the whole treatise in 1928 (2). The publication was a laborious one, as the printing was done by a Persian printing office in Berlin, and the proofs had to be sent to Lucknow in India. This difficulty of communication, according to the editor, is responsible for the very numerous misprints in the Arabic text.

ṢIDDÎQÎ wrote a short English preface and a very elaborate Arabic introduction from which I extract the following items :

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(1) E. G. BROWNE, *Arabian Medicine*. Cambridge 1921, p. 37-44.

(2) M. Z. SIDDIQI, *Firdausu'l-Ḥikmat*, or *Paradise of Wisdom* by 'ALÎ B. RABBAN AṬ-ṬABARÎ. Berlin, 1928, 8vo, XXXII+620+15 pp.

PAUL TANNERY
(1843-1904)

After a poem in honour of his late master E. G. BROWNE, to the memory of whom the edition is dedicated, ṢIDDÎQÎ refers to the time of the great Syriac-Arabic translators of the IXth century in Baghdâd, viz. YAḤYÂ B. MÂSAWAIH, ḤUNAIN B. ISḤÂQ, ISḤÂQ B. ḤUNAIN, ḤUBAISH, 'ÎSÂ B. YAḤYÂ and others (3). He thinks that, next to the Syriac treatises on medicine, 'ALÎ AṬ-ṬABARI's « Paradise of Wisdom » was the very first medical compendium written in Arabic. This is an error; besides the early Arabic translation of AHRÔN the Syriac priest's and archiater's « Medical Pandect » *(Kunnâsh fi'ṭ-Ṭibb)* there are records of Arabic medical books as early as the period of the first Abbasid caliphs at the end of the VIIIth and the beginning of the IXth century A.D. Such writers are, for example, MÂSARJAWAIH, MASÎḤ B. ḤAKAM and the above-mentioned YAḤYÂ B. MÂSAWAIH whose treatises exist in manuscript in many libraries. Anyhow, the « Paradise of Wisdom » is so far the earliest Arabic medical compendium published in print. ṢIDDÎQÎ gives after this a bio-bibliographical sketch from which I extract the following items :

I. — LIFE OF THE AUTHOR.

ABU'L-ḤASAN 'ALÎ B. SAHL (RABBAN) AṬ-ṬABARÎ is only very briefly mentioned in a few biographical works, and his biography seems to have been taken by the writers from remarks in his own book. His, or rather his father's name has been very often mutilated by the Arab authors, so that we find him mentioned as 'ALÎ B. ZAIN, B. ZAID, B. ZAIL, B. RAZÎN, B. RAYYAN, B. RABL, B. DABAL or B. DHABAL, etc. IBN AL-QIFṬÎ (4) renders the title *Rabban* correctly but with a false explanation, taking it for the Jewish title of *Rabbi*. So 'ALÎ B. RABBAN passed into all historical works, until quite recently, as a Muslim of Jewish origin, although 'ALÎ himself, in the preface to his work, explains this title *Rabban* as being the Syriac word for « our Master » or « our Teacher ». The late Professor HOROVITZ told me and wrote to me several years ago, that this was a Christian title; A. MINGANA gave the proof of

(3) See GEORGE SARTON, *Introduction to the History of Science*, I, Baltimore, 1927, p. 574 ff. and LECLERC, *Histoire de la Médecine arabe*, (Paris 1870) I, 202, foll.

(4) *Ta'rîkh al-Ḥukamâ'*, ed. LIPPERT (Leipzig 1903), p. 231.

this in print for the first time in 1922. 'ALÎ says in his apologetic tract « The Book of Religion and Empire » which he wrote about 855 A.D. that he himself was a Christian before he was converted to Islam, and that his uncle ZAKKÂR was a prominent Christian scholar. This tract is a defence of Islam against Christians, Jews, Hindus, Buddhists and Parsees.

Judging by autobiographical remarks taken from the preface to the « Paradise of Wisdom » ṢIDDÎQÎ thinks that 'ALÎ was born between 770 and 780 A.H. at Merw in the Persian province of Ṭabaristân.

This fixation of the time of 'ALÎ's birth, however, is based on an erroneous interpretation of the texts, of which I venture to offer a correction based on my own translation of them. In chapter 312 (p. 519 of the text) where 'ALÎ B. RABBAN writes on the celestial signs of coming events he relates the following : « There appeared in my time also a comet, and the direction of its tail *(dhû'âba)* was once to the East and once to the West, and it remained (visible) during a succession of nights. After this a large town in Ferghâna disappeared with all its inhabitants; and a host of people rose up against the Great King (i.e. the caliph) and he overcame them, but it was not long before he died and God gave the reign to HÂRÛN. And I observed in the latter's time one afternoon, when I was at *Surra-man-Râ'â* (5), a star (viz. meteor) shooting down from the direction of the South (*taiman*, Syriac word !) and falling to the North (*jarbiyâ*, Syriac), and it was spread out in the heaven and separated into flashes resembling written letters; and he (the caliph) died likewise some days later after a violent disease by which he was attacked. Several months before his death there appeared in the heaven an oblong fire remaining from midnight till nearly dawn ».

There is no doubt that the verb *inkhasafa* (to sink into the ground, to be swallowed up) means here an earthquake. Ferghâna, a large province in Transoxania (to-day in Russian Turkestan) has always been and still is a centre of violent tectonic earthquakes.

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(5) An euphemistic name (« Joy of him who sees her ») for Sâmarrâ, a second capital of the caliphate on the Tigris north of Baghdâd founded by the caliph AL-MU'TAṢIM in 836 A.D. It was the seat of seven caliphs and was abandoned in 889. The important ruins have been excavated by ERNST HERZFELD.

The one which was referred to by 'ALÎ AṬ-ṬABARÎ is very probably that mentioned by AL-GARDÎZÎ in the year 224 of the Hijra, i.e. 838-9, A.D. (BARTHOLD, *Turkestan down to the Mongol Invasion*, London, 1928, p. 210).

The second date referring to the accession of the caliph HÂRÛN can never be logically connected with the famous HÂRÛN AR-RASHÎD who died in 809, twenty-seven years before the foundation of Sâmarrâ *(Surra-man-Râ'â)* ! It refers to the tenth caliph ABÛ JA'FAR HÂRÛN AL-WÂTHIQ BI'LLÂH (842-847 A.D.), grandson of HÂRÛN AL-RASHÎD, and to his father and predecessor AL-MU'TAṢIM, the ninth Abbasid caliph. The latter had, indeed, to deal with several revolts on the part of his Arabian, Turkish and Persian generals. The apparition of two bright comets shortly before his death (842 A.D.) is also described by IBN AL-QIFṬÎ (6). HÂRÛN AL-WÂTHIQ's disease to which 'ALÎ B. RABBAN alludes and from which the ruler died in 847 A.D. was insufferable thirst, probably diabetes.

Another erroneous interpretation made by ṢIDDÎQÎ refers to a passage on p. 518, line 22 foll. of the printed edition of the *Firdaws al-Ḥikma*. It runs as follows :

« I saw in Ṭabaristân (7), while I was saying my evening-prayer with my father, a fire rising from the South *(taiman)* and passing to the North *(jarbiyâ)* in the form of a thick and long cylinder *(usṭuwâna)*; it was then not long before the king of its (Ṭabaristân's) mountains had to deal with trouble, was expelled from his mountains and towns, and returned there later on, after having experienced terrible misfortunes and having suffered a decrease of power ».

ṢIDDÎQÎ (p. VII) thinks that this must refer to one of the revolts of the Persian prince WANDÂD HURMUZD during the reign of HÂRÛN AR-RASHÎD, reported in IBN ISFANDIYÂR's History (8). He determines it more exactly as about the year 785 A.D., so that he fixes the date of 'ALÎ B. RABBAN's birth at about 775 A.D.

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(6) *Ta'rîkh al-Ḥukamâ*, p. 156.

(7) The Persian province between the Caspian Sea and the mountain chain of the Elburz.

(8) *An abridged Translation of the History of Ṭabaristân... by Muḥammad b. al-Ḥasan b. Isfandiyâr...* by EDWARD G. BROWNE (Gibb Memorial Ser. II), Leyden, London, 1905, p. 130-1.

But, firstly, this insurrection had already occurred before the death of the caliph AL-MAHDÎ (775 A.D.), and secondly, it was a revolt of the Persian prince against the caliph, whilst the text of the « Paradise of Wisdom » clearly speaks of a revolt of the people of Ṭabaristân against their « King of the Mountains ». So this must refer to one of the numerous troubles related by IBN ISFANDIYÂR (pp.143-152) as having occurred during the caliphate of AL-MA'MÛN (813-833 A.D.). Unhappily the Persian historian gives no exact dates, and 'ALÎ B. RABBAN mentions no names. So it is not possible to determine even approximately the birth-date of the latter. It is very probable that he was a contemporary of and of the same age as the famous translator ḤUNAIN B. ISḤÂQ (809-877), as he quotes him frequently. According to ṢIDDÎQÎ he must have written his medical book, which forms the subject of the present essay and which he finished in 850 A.D., at the age of seventy-five, and still later have been converted to Islam, and at the age of eighty have written his apology for Islam (9) ! And it would be still less possible that he could have been the teacher of the great Persian physician MUḤAMMAD B. ZAKARÎYÂ' AR-RÂZÎ who, according to a recently translated note by AL-BÎRÛNÎ, was born in 865 A.D. (10).

'ALÎ's father SAHL with the honorary title of Rabban was a medical man, but interested also in other sciences. IBN AL-QIFṬÎ (p. 186) mentions a translation of PTOLEMY's *Almagest* by SAHL RABBAN ; NALLINO shortly discusses the veracity of this assertion (11). 'ALÎ was instructed, as he himself states, by his learned father in the Syriac and Arabic languages, in medicine, mathematics and philosophy and, as he alleges, also a little in Hebrew and Greek. So 'ALÎ was able, later on, to translate his great medical treatise from Arabic into Syriac, and to quote, in his « Book of Religion and Empire », long passages from the Old Testament. But for this there is the simple explanation given by MINGANA (*l. c.* p. XVIII foll.) that 'ALÎ quoted from

(9) *The Book of Religion and Empire...* by 'ALÎ ṬABARÎ, ed. A. MINGANA, Manchester, etc. 1922.

(10) J. RUSKA, *Al-Bîrûnî über das Leben und die Schriften al-Râzî's.* In *Isis* V. (1922), p. 32-33.

(11) *Al-Battânî. Albatenii Opus Astronomicum* ed. C. A. NALLINO I, p. 310 foll. He is mentioned as an astrologer in IBN ABÎ UṢAIBI'A I, p. 120 foll.

one of the Syriac translations of the Bible (12). 'ALÎ is expressly called a Christian by the Historians AN-NADÎM, MUḤAMMAD AṬ-ṬABARÎ and IBN KHALLIKÂN (MINGANA pp. XI and XIII).

We learn from 'ALÎ IBN RABBAN's own words that later on he was secretary to the Persian prince MÂZIYÂR B. QÂRIN, grandson of the above-mentioned WANDÂD HURMUZD and governor of Ṭabaristân; it is, moreover, reported that he went for him to Baghdâd to the court of the caliph AL-MA'MÛN and to Rayy (Rhages) where AR-RÂZÎ (RHAZES) the most celebrated of all the Arabo-Persian physicians is said to have been his pupil. ṢIDDÎQÎ accepts this assertion of IBN AL-QIFṬÎ (*l. c.* p. 231), but I think that this is not possible, as 'ALÎ B. RABBAN was a man of at least seventy-five when AR-RÂZÎ reached the age of learning. Moreover the sojourn of 'ALÎ B. RABBAN at Rayy, RÂZÎ's birthplace, seems to have been about 840 A.D., after the defeat and before the cruel execution of his master MÂZIYÂR (d. 841 A.D.). There is no evidence that 'ALÎ returned to Rayy in his later years. After the violent death of MÂZIYÂR, 'ALÎ seems to have served as a secretary to the caliphs AL-MU'TAṢIM (833-842), AL-WÂTHIQ (842-47) and AL-MUTAWAKKIL (847-61 A.D.). The last-mentioned ruler converted him to Islam, and it was for him that he wrote the above-mentioned apologetic tract against Jews, Christians and Magians (13), which he finished in the third year of the caliph (viz. in 850 A.D.). 'ALÎ IBN RABBAN must have died some time subsequent to this date, but no historian records the year of his death (13[a]).

ṢIDDÎQÎ then gives a list of 'ALÎ's literary output following

(12) As to the early version *(Peshiṭṭâ)* see G. SARTON, *Introduction*, vol. I, p. 288, foll.; moreover D. S. MARGOLIOUTH, Proceedings of the British Academy, vol. XVI (1930), May 21.

(13) IBN ABÎ UṢAIBI'A relates (I, p. 309) that 'ALÎ was converted to Islam by the caliph AL-MU'TAṢIM. This is not possible, as the *Firdaws al-Ḥikma*, written eight years after this caliph's death, in 850 A.D., does not contain any Mohammedan sentences or quotations from the Qur'ân; on the contrary it presents many quotations from the Old Testament. So I think that 'ALÎ's conversion took place after 850 A.D. during the reign of the caliph AL-MUTAWAKKIL. This is perfectly in accordance with the opinion of MINGANA (*l. c.* p. IX foll. and p. XVI) that 'ALÎ's conversion took place about 855 A.D.

(13[a]) For more details on 'ALÎ's life, see my biographical study mentionned in note 39.

the *Fihrist*, IBN ABÎ UṢAIBI'a and occasional references in 'ALÎ's own works. It comprises fourteen books, mostly on hygiene and medicine but also on charms and two Islamic apologetic tracts. As all this output, besides three of his books, is lost, it is doubtful whether all these publications are authentic. Some of the titles seem to be synonyms for the same work.

Besides the two afore-mentioned books there is a hitherto unpublished book on Hygiene *(Ḥifẓ as-Siḥḥa)* extant in a unique copy in the Bodleian Library at Oxford (No. 578). ṢIDDÎQÎ concludes from his study of 'ALÎ's books that he was not free from superstitious practices; and we shall indeed meet such practices in the course of our analysis of the « Paradise of Wisdom ».

In ṢIDDÎQÎ's biographical sketch I find no allusion to the information imparted by European writers to the effect that 'ALÎ B. RABBAN was a pupil of ḤUNAIN B. ISḤÂQ. This is indeed possible, as he quotes him frequently. But there is no evidence for it in Oriental sources. It is more probable that both these scholars were pupils of the venerable YAḤYÂ B. MÂSAWAIH, (d. 857 A.D.), physician and chief of the « House of Wisdom », the library and translation institute founded by the caliph AL-MA'MÛN in Baghdâd.

II. — THE « PARADISE OF WISDOM » *(Firdaws al-Ḥikma)*.

This is one of the oldest complete Arabic compendiums of medicine and natural philosophy which have come down to us. In its arrangement it partly follows the Greek compendiums of e.g. ORIBASIOS and PAUL OF AEGINA, and it has been imitated in its turn by many other Arabic medical writers. What distinguishes this book and makes it unique of its kind is the sketch on Indian medicine at the end, which follows the books of CHARAKA, SUSHRUTA, the *Nidâna* (14) and the *Ashtâṅgahṛadaya* (15). 'ALÎ's compendium has been quoted by

(14) SUSHRUTA is the celebrated early surgeon, CHARAKA the early Indian physician who left great treatises on Medicine (see GEORGE SARTON, *Introduction to the History of Science*, vol. I, pp. 76 foll. and 284). The *Nidâna* is a famous work on pathology by a physician named MÂDHAVAKARA. This work is said to have been translated into Arabic by order of the caliph HÂRUN AR-RASHÎD (VIIIth cent. A.D.). See G. MUKHOPÂDHYÂYA, *The surgical Instruments of the Hindus* (Calcutta 1919) vol. I, p. 29.

(15) The *Aṣṭaṅga Hṛdaya Saṁhitâ* (« Compendium of the Essence of the Octo-

many early and by a few late Arabic medical authors. ṢIDDÎQÎ enumerates as such AR-RÂZÎ (RHAZES) in his *Ḥâwî (Continens)* and in the « Precious Book » *(al-Fâkhir)* (which is, however, only ascribed to him), BADR AD-DÎN AL-QALÂNISÎ (XIIIth century) and IBN AL-BAIṬÂR (XIIIth century) in their pharmacologies, and NAFÎS (B. 'AWAḌ) AL-KIRMANÎ (XVth century) in his commentary on (NAJÎB AD-DÎN AS-SAMARQANDÎ's) « Causes and Symptoms ». The « Paradise of Wisdom » is, moreover, mentioned in AL-BÎRÛNÎ's « India », (SACHAU's translation 1910, vol. I, 282), in YÂQÛT's Arabic Geography (III, 507, 549), in IBN ISFANDIYÂR's « History of Ṭabaristân » (Gibb Memorial edition, p. 35-36), in AL-BALKHÎ's « Wonders of the Things » (BROWNE Or. M. G. II (12) f. 68*a*) and in AD-DAMÎRÎ's « Life of Animals » (BÛLÂQ edition II, 442). The famous Arabo-Persian historiographer MUḤAMMAD B. JARÎR AṬ-ṬABARÎ is said to have read the « Paradise of Wisdom » while he was sick and confined to bed.

As for the quotations from Greek sources which are found in the « Paradise of Wisdom » there are about 120 from HIPPOCRATES, most of which have been identified by Dr. TH. WITHINGTON and appended to the Arabic print in the English Appendix II. They include more than 60 of the *Aphorisms*, the others being from the *Prognostics*, *Airs*, *Waters and Places*, *Epidemics*, *De Natura Pueri*, *De Flatibus* and *Acute Diseases*. Some 20 quotations from GALEN and 13 from DIOSCORIDES' *Materia Medica* have been identified by WITHINGTON, but there are many more of them. Other medical authors who are quoted are ARCHIGENES and MAGNES OF EMESSA, besides the philosophers ARISTOTLE, THEOPHRASTUS, DEMOCRITUS, STEPHANUS, ALEXANDER and ANAXIMENES (16). PYTHAGORAS is likewise mentioned, but the Arabs

partite Science ») by VÂGBHAṬA II. (« the Younger ») is an extract from the *Aṣṭâṅga Saṁgraha* (« Summary of the Octop. Sc. ») by VÂGBHAṬA I. (« the Elder »). The dates of all these physicians are still uncertain; they probably fall within the first six centuries A.D. As to details see, besides the books quoted by SARTON, T. A. WISE, *Commentary on the Hindu System of Medicine*, Calcutta 1845, A. F. R. HOERNLE, *Studies in the Medicine of Ancient India*, Part I (Oxford 1907) pp. 1-18 and JULIUS JOLLY, *Medicin*, in *Grundriss der indo-arischen Philologie*, III, 10, Strassburg 1910.

(16) The editor could have done with WITHINGTON's help for this part of his introduction, as he did not recognise many of these names, writing, for example, « Axominos » instead of ANAXIMENES and ALEXANDER « the Traveller » (*al-Ṭawwâf*) instead of « THE PERIPATETIC », i.e. ALEXANDER OF APHRODISIAS.

did not possess any of his original works. The only Arabic authors who are quoted are MÂSARJAWAIH, YUḤANNÂ B. MÂSAWAIH and ḤUNAIN B. ISḤÂQ, the last two being 'ALÎ IBN RABBAN's contemporaries. Five books which have not been identified are repeatedly quoted : A « Book of Explanation of Obesity, Emaciation and Disturbance of Coition », a « Book of Creatures » *(? Kitâb al-Ahwaz)*; a « Book on the Eye » (perhaps that of ḤUNAIN B. ISḤÂQ ?) (17); a « Book of the Natures of Animals » (perhaps ARISTOTLE's *Historia Animalium*) and a « Book of Agriculture ». ṢIDDÎQÎ strove to identify the last-mentioned book; but he considered it similar to, but not identical with the translation of the Greek *Geoponica* by « QOSTÛS IBN ASKÛRASKÎNA ». We know now through the investigations of J. RUSKA that this is the *Geoponica* by CASSIANUS BASSUS. But I am inclined to be of the opinion that these passages are quoted from the « Book of Agriculture » written by VINDANIUS ANATOLIUS, which had been translated into Arabic during the caliphate of HÂRÛN AR-RASHÎD. An Arabic MS. of this translation was recently discovered in Syria by Father PAUL SBATH; but owing to his absence from Cairo I have not been able to collate the texts.

III. — THE MANUSCRIPTS.

ṢIDDÎQÎ had at his disposal five Arabic MSS. of the *Firdaws al-Ḥikma* : 1° Arundel Or. 41 British Museum, London. This is an almost complete copy of 552 pages of 21 lines each. It is not dated, but written in Maghrebine handwriting in the XVIth century. It has been in the possession of several Indian and Persian scholars. 2° An incomplete copy in the Berlin State Library (Landberg Fund No. 266), not dated, but doubtless from the XIIIth century and the oldest of all the existing copies. 3° A MS. which is in the possession of the Grand-Ducal Library of Gotha (No. 856 A 1910); it is incomplete and dated 1008 A.H. (1600 A.D.). 4° A nearly complete copy in the possession of the physician KHWÂJA KAMÂL AD-DÎN of Lucknow (India), dated 1097 A.H. (1686 A.D.); 5° A copy of the MS. 4° in the Library

(17) See M. MEYERHOF, *The Ten Treatises on the Eye ascribed to Ḥunain b. Isḥâq*, Cairo, 1928.

of Râmpûr (India). The text is based for the first 550 pages of the printed edition on the MSS. 1°, 2°, and 3°, and for the last seventy pages also on 4°. A list of printer's errors concludes the introduction which is followed by an index of chapters and pages.

After a careful study of the Arabic text of 'ALÎ B. RABBAN's « Paradise of Wisdom » I have some remarks to add to ṢIDDÎQÎ's introduction : The book is much more dependent on GALEN's medical writings than ṢIDDÎQÎ's and WITHINGTON's quotations from this author show. The question is, from which translations did 'ALÎ B. RABBAN extract his paragraphs ? I am of the opinion that he took them chiefly from ḤUNAIN's numerous Syriac and few Arabic versions which this celebrated translator had accomplished up to 850 A.D., the date of the definite edition of the « Paradise of Wisdom ». The Arabic technical terms are, in general but not always, those created by ḤUNAIN. Syriac terms are rather frequent, Persian terms abound, particularly in the pharmacopoeia which is very full and includes most of the drugs recorded in the XIIIth century by IBN AL-BAIṬÂR and many others. I have been at great pains to identify the terms which are missing from the *Materia Medica* of this author (ed. L. LECLERC, *Traité des Simples par Ibn al-Beithar*, Paris 1877-83), to explain the names of compound remedies, and to restore the very much mutilated names of Greek and Persian medicines. There are many Indian drugs which were unknown to the Greeks, and many recipes, also some which had been invented by 'ALÎ himself and his father SAHL (Rabban). The frequent mention of papyrus as a medium for plasters seems to me a proof of the authenticity and the early date of the book, as the trade in papyrus ceased in Asia in the Xth century. The designation of weights and measures is sometimes remarkable, e.g. the frequence of the application of the *istâr* (plur. *asâtîr*), i.e. four *mithqâl*'s, and of the *sukurja* or « bowl » as a measure— besides the *raṭl* (pound), *dirham* (drachm), and *uqiyya* (ounce).

Popular and superstitious practices are frequently described, and 'ALÎ B. RABBAN seems to believe in their efficacy.

Considered as a whole, the « Paradise of Wisdom » is a compilation of Greek and Indian Medicine with an influx of Persian drugs, a confused and confusing piece of work. As noted already by BROWNE (p. 42), it contains very little about anatomy and

surgery. On the other hand the theoretical parts, the physio-pathological theories of HIPPOCRATES, GALEN and the Indians are too detailed, whilst the descriptions of diseases are poor or entirely missing. Clinical notes are rare. The description of therapy by internal and external remedies is very explicit and sometimes mixed with superstitious recipes. Here the Author shows considerable knowledge of the Old Testament in its Syriac version, which confirms the observations to which many passages occurring in his apologetic tract « Book of Religion and Empire » give rise. Anyhow this book is very far removed from the systematic clearness of the Greeks and from the skilful arrangement of the works of later Arabo-Persian authors, e.g. RHAZES, 'ALÎ B. AL-'ABBÂS and AVICENNA. The historical importance of the « Paradise of Wisdom », however, can hardly be overrated, and this is the reason why I have made an analysis of the contents of the bulky volume.

IV. — THE CONTENTS OF THE « PARADISE OF WISDOM »

E. G. BROWNE (*l. c.* pp. 42-44) has already given a general plan of the book which is composed of seven Parts *(nâw')*, thirty Discourses *(maqâla)* and three hundred and sixty Chapters *(bâb)*, and introduced by a preface of seven pages.

In this preface 'ALÎ B. RABBAN first writes about his own scientific education, mentions (on p. 2 of the print) that he completed his book in the third year of the caliph AL-MUTAWAKKIL (i.e. 850 A.D.) at Sâmarrâ (in Mesopotamia), and explains the aims of the book. He believes that he has followed the rules given by HIPPOCRATES and ARISTOTLE for the introduction to the knowledge of Philosophy and Medicine, proceeding from generalities to the special study of each branch. He thinks that he has written a more comprehensive and intelligible book than his predecessors have done.

By reason of the great length of the book I am obliged to limit my analysis to the translation of the headings of the 360 chapters, (their successive numeration being mine !), sometimes casting a glance at their contents. Rare or remarkable names of remedies or technical terms are specially mentioned and form the subject of the two glossaries appended to this paper.

PART I (pp. 8-30 of the printed edition), subdivided into 12 chapters, treats of general philosophical ideas, mostly following ARISTOTLE.

Chapter 1 : On the Name of the Book and its Composition. The Author mentions among his sources, besides HIPPOCRATES, GALEN and ARISTOTLE, expressly ḤUNAIN B. IṢḤÂQ, his contemporary and pretended master.

Chapter 2 : On Matter *(hayûlî, ὕλη)*, Shape, Quantity and Quality.

Chapter 3 : On simple and compound Temperaments *(ṭabâ'i')* (i.e. fundamental qualities and elements) and the Refutation of the opinion of those who allege the Existence of a fifth (Temperament) (18).

Chapter 4 : On the Antagonism of these Temperaments and the Refutation of the Opinion of those who allege that the Air is cold (of temper.). The author gives (p. 14) a diagram of the four temperaments and their antagonistic action.

Chapter 5 : On the Genesis of Temperaments one from another.

Chapter 6 : On Metamorphosis *(istiḥâla)*. PLATO is quoted.

Chapter 7 : On Genesis and Decay.

Chapter 8 : On Activity and Passivity *(fi'l wa'nfi'âl)*.

Chapter 9 : On the Genesis of Things from the Elements, the Action of the Celestial Sphere and the Luminous Bodies *(nayyirât)* therein.

Chapter 10 : On the Effects of the Action of the Elements on the Air and subterranean Conditions : meteorology, earthquake, etc.

Chapter 11 : On shooting Stars and the Colours which are generated in the Air. (Rainbow).

Chapter 12 : On the Genesis of Animals living on the Earth, in the Sea and in the Air, and on the Genesis of their Organs.

PART II (p. 30-114) : Physiology and Hygiene.

DISCOURSE I.

Chapter 13 : On the Genesis of the Embryo.

Chapter 14 : On the Period in which the Embryo is formed.

Chapter 15 : On the Cause of the Genesis of Male and Female,

(18) This chapter has been partly translated by E. G. BROWNE (*Arabian Medicine* p. 116 foll.)

the Frequence of Births, on the Cause of Malformation, Perfection and Defectiveness of Organs. Mostly following HIPPOCRATES' *De Natura Pueri.*

Chapter 16 : On the Symptoms of Pregnancy and Prediction of Sex.

Chapter 17 : HIPPOCRATES on Pregnancy and its Symptoms.

Chapter 18 : On Miscarriage and Alleviation of Delivery.

Chapter 19 : On the Causes of the Genesis of Temperaments *(mizâjât κράσεις)* and Organs.

Chapter 20 : On the Stomach, the Condition of Aliments in it and the Faculties of the four Temperaments. (Following GALEN, ed. KÜHN I p. 572).

Chapter 21 : On the Causes of reflex and voluntary Movement, on the Brain, Heart and the Origin of Nerves and Blood-vessels.

Chapter 22 : On the Cause of the Rotundity of the Head and the Proofs of it.

Chapter 23 : On the Orifices *(khurûj)* of the Head and the Outlets for the Superfluities *(fuḍûl)* of the Body.

Chapter 24 : On the Skin, Hair, Nails and Teeth.

Chapter 25 : On the Cause of upright Carriage *(intiṣâb)* of Men (alone) among the Animals, the Detachment of Hands and Feet (arms and legs) and the Similarity of Men to the Microcosm. The MSS. render the latter part of the title in different ways, some reading « Macrocosm »; but the Berlin MS. which is the oldest of all gives the correct explanation that man is analogous to the parts of the world and that he is therefore called a microcosm. The « Author of the Physiognomy » *(ṣâḥib al-firâsa)* is quoted (probably PSEUDO-POLEMON whose book was translated into Syriac and Arabic at an early date.).

Chapter 26 : On the Cause of Length, Shortness, Crookedness and Straightness and the Colours of the Body.

Chapter 27 : On the Cause of the Beard, of white Hair *(shaib)*, Baldness *(ṣal')* and the Youth of Animals.

Chapter 28 : On Puberty *(iḥtilâm)* and the Menses *(tamth)*.

Chapter 29 : On the Kinds of Organs, their Faculties and Functions.

Chapter 30 : On Ages, Seasons of the Year, and the Difference between Night and Day. This chapter again is followed by a diagram of the seasons and the four points of the compass.

DISCOURSE II.

Chapter 31 : Discussion of the Soul and that it is neither an *Accidens* nor one of the Temperaments. Following ARISTOTLE.

Chapter 32 : That the Soul is not compound. On Movements and the Refutation of the Opinion of those who contest them.

The « seven » movements of human beings are meant and the discussion of their ability to move. (PSEUDO-) THEOPHRASTUS and (PSEUDO-) PYTHAGORAS are quoted.

Chapter 33 : That the Soul is not in the Body like the Genesis of (other) Things one in another; and that Light is neither a Body nor Fire.

At the beginning « ALEXANDER the Sage » (OF APHRODISIAS) is quoted; the second part follows ARISTOTLE's *De Anima* (19).

Chapter 34 : That the Body is possessed of Souls which pass away with the Body.

The souls of men, animals and plants are meant.

Chapter 35 : On Reason, Matter *(hayûli)*, and the ten Things of which Speech is compounded. ARISTOTLE's categories are meant.

Digression on PYTHAGORAS' doctrine of numbers.

Chapter 36 : On imaginative Power *(wahm)* and the other Senses.

Chapter 37 : On the perceptive Power of the Eye.

Following ARISTOTLE who propounded the theory that the light reflected from objects meets the eye (20).

Chapter 38 : On the other Senses.

Chapter 39 : That Colours, Flavours and Smells are *Accidentia* and not Bodies, as some People pretend.

Chapter 40 : On the Faculties ruling and preserving the Body.

This chapter treats of vital, animal and natural faculties, following GALEN's *De Facultatibus naturalibus*.

DISCOURSE III.

Chapter 41 : On the Signs of the Temperaments of the Bodies.

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(19) Compare M. MEYERHOF and C. PRÜFER, *Die aristotelische Lehre vom Licht bei Ḥunain b. Isḥâq. Der Islam* II (1911) p. 117 foll., and L. CHEIKHO, *Notice sur un ancien manuscrit arabe*. Notices et manuscrits, sect. musulmane, Paris, 1897, pp. 127-142.

(20) Compare M. MEYERHOF, *An Arabic Medico-philosophical Compendium*. *Isis* X, (1928) pp. 347-8.

Chapter 42 : On the Signs of the Temperament of the Brain.

Chapter 43 : On the Signs of the Temperament of the Heart.

Chapter 44 : On the Signs of the Temperament of the Liver and Stomach.

All these chapters follow GALEN *De Temperamentis*.

Chapter 45 : On Hunger, Thirst, Sleep, Sleeplessness, Laughing, Weeping, Fatigue and the like.

Chapter 46 : On Merriness, Sorrow, Confusion *(khajal)*, and Weariness *(waja[1])*.

Chapter 47 : On Lust *(shahwa)*, Reflection *(fikra)*, and Wrath *(ghaḍab)*.

Chapter 48 : On Courage *(shajâ'a)*, Cowardice *(jubn)*, Injustice *(jawr)*, Avarice *(bukhl)*, Foresight *(ḥilm)*, Thoughtlessness *(nazaq)*, Hastiness *(ḥidda)*, Vanity *(zahw)*, Modesty *(tawâḍu')*, Love *(ḥibb)* and Hatred *(bughḍ)*.

Chapter 49 : On Levity *(khiffa)*, Gravity *(thiql)*, retentive and weak Memory *(ḥifẓ wa-nasayân)*.

Chapter 50 : On Sneezing *('uṭâs)*, Stretching of the Arms *(tamaṭṭî)*, Tickling *(daghdagha)*, Quivering *(ikhtilâj)* and Numbness *(khadar)*.

The author considers such movements as means to eliminate bad superfluities *(fuḍûl, περιττώματα)* from the body. He adds yawning *(tathâ'ub)* and shuddering *(qush'arîra*, horripilation).

Chapter 51 : On Dreams, evil Dreaming *(iḥtilâm)* and Nightmare *(kâbûs)*.

Chapter 52 : On Visions *(rû'yâ)* and Evil Eye *('ain)*.

This is, in general, a record of the opinions of philosophers and physicians on this subject, as well as of the wonders attributed to imaginative power by the Indians. At the end the author gives quotations from stories of miracles related by GALEN and in the Old Testament, notably the story of the resuscitation of Samuel by the prophetess of Endor. (Sam. I, c. 28).

DISCOURSE IV.

Chapter 53 : On the Nursing and Hygiene of the Newborn Child.

Chapter 54 : On the Nursing of the Grown-up Child.

Chapter 55 : On Hygiene.

Chapter 56 : On the Diet of each Temperament at every Age.

Chapter 57 : On the Diet of (the different) Organs.

DISCOURSE V.

Chapter 58 : On Diet in Spring.

Chapter 59 : On Diet in Summer.

Chapter 60 : On Diet in Autumn.

Chapter 61 : On Diet in Winter.

Chapter 62 : On Travels and Campaigns.

Chapter 63 : On thinning, fattening and appetizing Things (Aliments).

Chapter 64 : On the Kinds of Atrophy *(ḍumûr)* and on Diet useful and harmful to (the different) Organs.

All the preceding chapters follow GALEN *De Sanitate tuenda*.

PART III (pp. 114-120) : On the Cause of Nutrition (21) and the Assimilation of Aliments by Bodies.

Chapter 65 : On the Cause of Nutrition. Following ARISTOTLE.

Chapter 66 : On the Quantities of Aliments [to be taken] and on those which are [to be taken] first and last [at the beginning and end of the meal].

Chapter 67 : On the Kinds of Aliments, their Qualities and Effects. Following GALEN *De Alimentor. Facult.*

PART IV (pp. 120-356; this is the main part of the book) On Diseases and Treatments.

DISCOURSE I.

Chapter 68 : On the Number of general Diseases.

Chapter 69 : On the Kinds of general Diseases and their Causes.

Chapter 70 : On the Disease of each Stage of Life and in each Season. According to HIPPOCRATES.

Chapter 71 : On the Things which stir the four Humours *(akhlâṭ)* when they are corrupted and disturbed.

Chapter 72 : On the Causes of the Disturbance *(hayajân)* of these Temperaments *(ṭabâ'i')*.

Chapter 73 : On the Symptoms which indicate their Disturbance.

Chapter 74 : On the Symptoms of internal Diseases.

The preceding chapters follow GALEN *De Symptomatum Causis* etc.

Chapter 75 : On the Rules *(qânûn)* of Treatment and the different Aspects (points of View) extant in them.

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(21) Here several misprints disturb the sense of the Arabic text.

Chapter 76 : On the Treatment of the Organs and on Dieting in acute Diseases *(amrâḍ ḥâdda)*.

Following HIPPOCRATES *De Diaeta Acutorum*.

DISCOURSE II : On the Diseases of each Organ, their Symptoms and Treatment.

Chapter 77 : On the [diseases of the Skin of the] Head : Alopecy *(dâ'ath-tha'lab)*, Ophiasis *(dâ'al-ḥayya)*, Baldness *(qara'* and *ṣal')*, white Scar *(waḍaḥ)* and Dandruff *(ibriyya)*, Cosmetics for the hair, Dyes *(khiḍâb)*.

Chapter 78 : On Wounds in the Head *(shajjât)*.

Chapter 79 : On the Diseases of the Brain.

Epilepsy *(ṣar'* or *al-maraḍ al-kâhinî*, i.e. divining disease, translation of HIPPOCRATES' ἱερὴ νοῦσος); solitariness, misanthropy, shyness *(waḥsha)*; melancholy (*waswasa* i.e. demonianism); delirium *(hadhayân)*; corruption of phantasy and reason *(fasâd al-khayâl wa'-l-'aql)*; amnesia *(nasayân)*; sleeplessness *(sahar)*; lethargy *(subât)*; tinnitus *(dawî)*; vertigo *(dawâr)*; tumour *(waram)*; moreover six kinds of headache : e.g. splitting headache, *(ṣudâ')*, cephalalgy of the whole head *(sanwartâ*, Persian-Syriac word) (22), hemicrania *(shaqîqa)*; and each kind caused by the brain, or by troubles of the stomach and the abdomen *(marâqq)*. The strange term *dhihâb ma' al-waḥsh* probably designates retirement through misanthropy.

Chapter 80 : On the Symptoms of Diseases of the Brain and their Accidents. Stories of sudden insanities and suicides due to hallucinations.

Chapter 81 : On the Treatment of Diseases of the Brain. « ALEXANDER THE PHILOSOPHER » and STEPHEN OF ALEXANDRIA are quoted, and a recipe for epilepsy belonging to the author's father is given (p. 145). Among the remedies is *maibufakhtaj*, an Arabo-Persian term for boiled wine.

Chapter 82 : On the Symptoms of those (Diseases) which are caused by the Stomach and the Bowels.

Chapter 83 : HIPPOCRATES' Sayings on the Brain.

Chapter 84 : On Tinnitus (Tingling of the Ears, *dawî wa-ṭanîn*).

Chapter 85 : On Vertigo *(dawâr wa-sadar)* its Symptoms and Treatment.

(22) See the etymological explanation of the word by E. G. BROWNE, *Arabian Medicine*, p. 35.

Chapter 86 : On Amnesia and Nightmare, their Symptoms and Treatment.

Chapter 87 : On the Kinds of Headache and their Symptoms.

Chapter 88 : On the Treatment of Headache.

Chapter 89 : On Hemicrania and its Treatment.

Chapter 90 : On Cephalalgy of the whole head *(sanwartâ)*, its symptoms and Treatment.

The Syriac word designates splitting headache in the entire brain and its membranes and is derived from the Persian *sar-band*, i.e. helmet. Among the remedies are « Greek or Persian *falûniyâ* », i.e. *φιλώνειον ἀνώδυνον*. The remedy *falûniyâ* was still known to several native Cairo bazaar druggists some twenty years ago. Another remedy is designated by a mutilated Syriac name composed with *kawkebâ*, i.e. star. A plaster of opium, dragon's blood and saffron with gum on papyrus, to be stuck to the temples, is mentioned.

DISCOURSE III.

Chapter 91 : On the Structure of the Eye.

This chapter follows GALEN's *De Usu Partium* and partly the Arabic nomenclature of ḤUNAIN, but is independent of his « Ten Discourses on the Eye ». The Author does not give any theory of vision here.

Chapter 92 : On the Diseases of the Eye.

Among those of the conjunctiva are the bloodspot *(ṭarfa)*, pterygium *(ẓafara)*, ophthalmia *(ramad)*, oedema *(intifâkh)*, sclerosis *(jasâ)*, psorophthalmia *(ḥikka)*, conjunctival congestion *(rîḥ as-sabal)*. In the cornea are ulcers *(qurûh)* and pustules *(bathr)*; the Author falsely terms an ulcer on the pupil *mûrsanaj*, i.e. *μυιοκέφαλον* or a small prolapse of the iris owing to a perforated ulcer, the staphyloma as *'inabiyya (uvea)* instead of *'inaba*. But this may be a copyist's blunder, as well as, in the following part, *intishâr* for *intithâr al-ashfâr* (falling out of the lashes). The abscess *(gharab)*, tumour *(ghudda)* and fistula *(nâsûr)* of the lachrymal caruncle. A short description of cataract *(mâ')* and of the ocular muscles and their affections concludes this chapter.

Chapter 93 : On the Symptoms of Eye-Diseases.

Other affections of the eye described in this and the next chapter are : amblyopia *(ḍabâb, ghishâwa)*, amaurosis *(ẓulma)*, night-blindness *('ashâ')*, lachrymation *(dam'a, sayalân)*, symblepharon

(shatra), lice *(qaml)* in the lashes, trachoma *(jarab)* which is not described; but treatment with copper eye-salves is recommended. Among the remedies we meet the Greek στατικόν *(asṭâṭîqûn)*, the eye-salve of HERMIAS *(shiyâf Armiyâlûs)* (23), another one with a Persian-Syriac name *(dabîd-murrâ)* (24) and some superstitious medicines (suspending of gall-bladders and eyes of crawfish at the temples).

Chapter 94 : On the Treatment of Eye-Diseases.

Besides Greek remedies, Persian and Indian drugs (myrobolans) and superstitious remedies are mentioned. For cataract there is no mention of the couching operation. Among the eye-salves is one with a mutilated Greek name *(ishṭîṭîfân*, i.e. στακτικόν or σταλτικόν*)* and another bearing a Persian name.

Chapter 95 : On the Treatment of the Lid, the Lashes, Eversion of the Lids *(shatar)* and Recipes for dry Collyria *(akḥâl)*.

Among the latter are noticeable the « wasp-collyrium » *(kuḥl zunbûrî)*, the τραχωματικόν, the βασιλικόν, for which a Persian name is *rûshanâ'î* (i.e. φωσφόρος, light-bringing), a Theodotion by STEPHEN and ALEXANDER (OF TRALLES?), another containing *jashmîzaq (Cassia Absus L.)*, a drug unknown to the Greeks, and a recipe which 'ALÎ got from an inhabitant of 'Omân (Southern Arabia).

Chapter 96 : On the Diseases of the Ear and their Symptoms. Such diseases are suppuration *(qaiḥ)* (25), ulcers *(qurûḥ)*, swelling of the tonsils *(waram al-lawzatain)* etc.

Chapter 97 : On the Treatment of the Ear. Steaming with decoctions of plants is mentioned.

Chapter 98 : On the Diseases of the Nose and their Symptoms.

Chapter 99 : On Epistaxis *(ru'âf)* and its Treatment.

Chapter 100 : On nasal Catarrh *(zukâm)* and its Treatment.

Chapter 101 : On the Treatment and Cleaning of the Face.

Xanthelasma *(kalaf)*, freckles *(namsh)*, white spots *(waḍaḥ)* black scars *(âthâr sûd)*, erysipelas *(ḥumra*, in Persian : *bâdh-dishnâm)* (26). Besides this Persian word the drug-name for

(23) Mentioned by GALEN *De composit. med. sec. locos.* and PAULUS AEGINETA l. VII.

(24) *Dabîd* is the Persian word for electuary, *murrâ* Syriac for myrrh.

(25) The text always reads *qabḥ* (deformity) insted of *qaiḥ* (pus) !

(26) From *bâdhijnâm* (Vullers I, 162), erysipelas of the face, or *bâd-dijnâm* (Steingass).

zard-jubaq (Persian : *zard-chûb*, turmeric) is to be noticed.

Chapter 102 : On the Mouth, Teeth and Ozaena *(bakhr)*.

Disturbance of speech by polypes *(kathîr al-arjul)* and falling out of the central incisors *(thanâyâ)*, pustule *(bathr)* in the mouth, slackening of the gums *(istirkhâ' al-luththa)*, and spasm of the tongue *(tashannuj al-lisân)*. Superstitious remedies are not missing, e.g. suspending at the neck a hyaena's tooth or hairs (to be read *ḍab'* instead of *ḍabb*, i.e. Uromastix lizard which has neither hair nor teeth !). Tooth-powder *(sanûn)* given disinfecting power by the addition of tar is mentioned.

DISCOURSE IV.

Chapter 103 : On Spasm *(tashannuj)* and Shivering *(kazâz)*.

Chapter 104 : On the Symptoms of Spasm and Shivering.

Chapter 105 : On the Treatment of Spasm and Shivering.

Chapter 106 : On Tremor *(irti'âsh)*, Contortion *(wuthâ)* and their Treatment.

Chapter 107 : On Plegia *(fâlij, πληγή)* and facial Paralysis *(laqwa)*.

Chapter 108 : On the Symptoms of Plegia and facial Paralysis.

Chapter 109 : On their Treatment.

DISCOURSE V.

Chapter 110 : On the Throat *(ḥalq)* and the Uvula *(lahâh)*.

Chapter 111 : On the Symptoms of the Diseases of the Throat, Uvula and Tonsils *(lawzatân)*.

Chapter 112 : On their Treatment. Among other remedies we meet unslaked lime *(kils ghair matfî')*.

Chapter 113 : On the Diseases of Chest *(ṣadr)* and Voice *(ṣawt)*, (i.e. vocal organs).

Chapter 114 : Their Treatment.

Chapter 115 : On Shortness of Breath *(ḍîq an-nafs)* and Asthma *(rabw)*.

Chapter 116 : Their Treatment. Many Persian drugs and animal remedies, such as earth-worms.

DISCOURSE VI.

Chapter 117 : On the Stomach. Its diseases are : loss of appetite; perversion *(qabḥ)* of appetite (coal- and earth-eaters); canine appetite *(shahwa kalbiyya)*; hiccough *(fawâq)*; persistent vomiting *(qay')*, and eructation *(jashâ')*; spasm; tumours

(awrâm); diarrhoea *(istiṭlâq)*; atony *(istirkhâ)*; obstructions *(sudud)*, and ulcers *(qurûḥ)*.

Chapter 118 : On the Symptoms of the Diseases of the Stomach and Stomachache *(dubaila)*.

Chapter 119 : On the Treatment of Stomach [troubles] and Phthisis *(sill)*. Many Persian and Syriac names of remedies, and a remedy of the Author's invention.

Chapter 120 : On persistent Vomiting and its Treatment.

Chapter 121 : On the Treatment of Hiccough.

Chapter 122 : On the Treatment of the four Faculties and their Conservation. These are the attracting, retentive, digestive and expulsive powers (according to GALEN).

DISCOURSE VII.

Chapter 123 : On the Diseases of the Liver *(kabid)* : Obstructions, tumours, abscess, sclerosis and dropsy.

Chapter 124 : On the Symptoms of the Diseases of the Liver.

Chapter 125 : On Dropsy *(istisqâ'* or *mâ' asfar)*.

Chapter 126 : On the Treatment of the Diseases of the Liver.

Chapter 127 : On the Treatment of Dropsy. Mostly drugs known to Galen and Dioscurides.

DISCOURSE VIII.

Chapter 128 : On the Diseases of the Heart. Physiology of the heart and some anatomical remarks on the valves found by GALEN in the hearts of apes and cocks.

Chapter 129 : On the Symptoms and Treatment of Heart-diseases. The diseases are not well defined; —weakness, throbbing *(khafaqân)*, swoon *(ghashy)* etc. Among the remedies are Greek ones, such as the potion of THEODORETUS and the στομαχικόν, and Persian ones such as *faranj-mushk* (*Ocimum pilosum*, a kind of basil) (see chapter 242); and *bâdranj-bûya*, (mountain-balm, *Melissa offic. L.*); remarkable are raisins from Ṭâ'if (in Arabia) or Gushmhâ (?) near Merw (Eastern Persia).

Chapter 130 : On the Diseases of the Lungs, their Symptoms and Treatment, and on Cough *(su'âl)*. Abscess near the diaphragm *(ḥijâb)* and expectoration of its pus through the gullet *(ḥulqûm)*.

Chapter 131 : On the Symptoms of the Diseases of the Lungs and their Prognosis *(taqdimat al-ma'rifa)*.

Chapter 132 : On the Treatment of [diseases of] the Lungs.

Among the remedies are Persian ones : *sifistân* (27) i.e. sebestens *(Cordia Myxa L.)* and *narsiyân-dârû*, i.e. Shepherd's crook, and, as a diuretic, squill *('unṣûlan, Scilla maritima L.)*.

Chapter 133 : On the Treatment of Cough.

Pain in the chest is mentioned under the name of *shawṣa*. For cough in children a superstitious remedy is named, raven's dung and the stones from sponges *(isfanja)*. Other noticeable names of remedies are : *aṣṭarak* = *storax* and *ḥalbanîtha* (Syriac) = *galbanum*.

Chapter 134 : On Expectoration of Blood *(nafth ad-damm)*.

Chapter 135 : On the Symptoms of superior and inferior Hemorrhages.

Chapter 136 : On the Treatment of Expectoration of Blood. There is no good description of phthisis.

Chapter 137 : On the Gall *(mirâra)* and Jaundice *(yaraqân)*.

Chapter 138 : On the Symptoms of Gall-diseases.

Chapter 139 : Their Treatment.

A superstitious remedy—still in use in the Orient—is the suspending of a yellow glass-bead, the « jaundice-bead », round the neck; the Author found it useful.

Chapter 140 : On the Spleen *(tuḥâl)*.

Chapter 141 : The Treatment. The spleen is the « house of the yellow gall ».

DISCOURSE IX.

Chapter 142 : On the Diseases of the Bowels *(am'â)*, Diarrhoea *(istiṭlâq)* and Dysentery *(saḥj)*.

Chapter 143 : Their Symptoms.

Chapter 144 : HIPPOCRATES' Sayings on this Matter.

Extracted from the Aphorisms. Lientery is mentioned *(zulq al-am'â')*.

Chapter 145 : On the Treatment of Diarrhoea and Loss of Blood.

Other names for dysentery *(zaḥîr* or *dhûsanṭâriyâ)*, i.e. ulcer of the bowels *(qarḥ al-am'â')*, and loss of blood *(khurûj ad-damm, mashâ ad-damm)*. Many animal remedies in the form of a *mâṣûṣ*, i.e. meat or fowl cooked with vinegar; moreover Persian drug names, such as white lily *(râziqî)* and barberry *(zîrishk jabalî)*.

(27) Spelt in other passages *sipistân* or *sibistân*.

Chapter 146 : On the Colon *(qûlûn*, large intestine) and the Causes by which the Superfluities are retained in the Organs.

Chapter 147 : On the Symptom of Pain in the Colon.

Chapter 148 : On the Treatment of the Colon, Worms *(dîdân)* and Tape-Worms *(ḥabb al-qar'*, Proglottides).

The name for colic is *qawlanj*, that for flatulence *riyâḥ*. The ileus bears its Greek name *îlâûs (εἴλεος)*. The remedies for worms do not contain any efficacious drug.

Chapter 149 : On the Diseases of the Kidneys.

Ulcer *(qarḥa)*, corrosion *(âkla)*, tumour *(waram)*, obstruction *(sudud)* by stone *(ḥaṣâ)* or a thick fluxion *(rîḥ ghalîẓ)*.

Chapter 150 : Their Symptoms.

Chapter 151 : On the Treatment of Cold *(bard)* in the Kidneys.

Diet with blanquette *(isfid-bâgh)* (28) and mutton. The name *fandâdîqûn* may be *πενταδικον*, i.e. compound of five drugs (see *fanjânûsh* in the glossary). Description of a half-superstitious remedy composed of roasted scorpions.

Chapter 152 : On the Diseases of the Bladder.

Stillicidium *(taqṭîr al-bawl)*, relaxation *(istirkhâ')*, ischury *(asr, ḥuṣr al-bawl)*, stone *(ḥaṣâ)*.

Chapter 153 : Their Symptoms.

Chapter 154 : Their Treatment.

Among the recipes again occur the Greco-Syriac names *falûniyâ (φιλώνειον)*, *kawkabâ* (*ἀστήρ*, star) and *âthânâsiyâ* (*ἀθανασία*, « immortality », name of a remedy) which are to be noted. Burnt papyrus and superstitious remedies are cited.

Chapter 155 : On the Diseases of the Penis *(iḥlîl)*.

Satyriasis *(kithrat al-intishâr)*, spermatorrhoea *(khurûj al-mannâ)* and aspermatism *(qillat al-mannâ)*.

Chapter 156 : Their Treatment, and Aphrodisiac Remedies.

This chapter is long and full of curious recipes. One e.g. consists of the testicles of seven cocks, the brains of seven ducks, chickens and sparrows, oil of the skink-lizard *(Scincus officinalis, asqanqûr)*, wild onion *(isqîl*, i.e. *σκίλλα)*, Sarcostemma viminale *(? qaḍabân al-'ajâjîl)*, eggs of seven crawfishes, seven lily-roots and seven sparrow's eggs, etc.

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(28) *Safîd-bâ* is, according to the Persian dictionaries, « a kind of white soup made from curds to which they add meat and spinach ».

The tablet *(qurṣa)* of Androclus (to be read Andromachus) is mentioned among the compound remedies.

A sub-title of this chapter is : On Hernia *(adara)* and Hydrocele *(rîḥ al-khuṣiyya)*.

Chapter 157 : On the Diseases of the Anus *(muq'ada)* and Fistula *(nâsûr)* and their Treatment.

Among the remedies I noticed depilatory (*nûra*, with arsenic), potash *(qilâ)*, *bulbus* (the Greek βόλβος, probably colchicum or the emetic onion, *Muscari moschatum Desf.*), and Persian names.

Chapter 158 : On the Diseases of the Uterus *(raḥam)*.

These are barrenness *('uqm)*, loss of sperm *(izlâq az-zar'*, i.e. sterility from another cause), strangulation *(ikhtinâq)*, dysmenorrhoea *(nazaf damm al-ḥaiḍa)*, amenorrhoea *(iḥtibâs al-ḥaiḍa)*, tumours *(awrâm)*, corruption of the temperaments *(fasâd al-mizâjât)*.

Chapter 159 : Their Symptoms.

Chapter 160 : Their Treatment and on the Facilitation of Child-birth.

Among the drugs are Greek and Nabathaean resin *('ilk al-Arwâm wa'l Anbât*, i.e. mastic and turpentine), civet's dung *(khurw as-sinnawr)*, many Greek and Syrian compound remedies and a great many superstitious practices, among others the writing of amulets in Syriac from the Psalms of David (Psalm 142, v. 18).

DISCOURSE X.

Chapter 161 : On the Kinds of Fevers *(ḥummayât)*.

Chapter 162 : On the Cause of the *âfîmarûs* (ἐφήμερος), i.e. One Day (ephemeral) Fever *(ḥummâ yawm)*.

Chapter 163 : On the Causes of the nine species of Ephemeral Fever and its Treatment.

Chapter 164 : On the Cause of Hectic Fever *(aqṭîqûs*, ἑκτικός*)*. Amongst other causes phthisis is mentioned.

Chapter 165 : On the Symptoms of Hectic Fever.

Chapter 166 : On the Treatment of Hectic Fever and on Phthisis *(sill)*.

Chapter 167 : On the Synochos *(sînâkhûs*, σύνοχος, continuous), i.e. the Blood-Fever *(ḥummâ damm)*. One of HIPPOCRATES' observations is related.

Chapter 168 : On the Treatment of Blood Fever.

If there is drum belly, the prognosis is bad.

Chapter 169 : On ἀμφημέρινος *(anfarîyâqûs*, to be read *anfîmârînûs)*, i.e. the mucous fever which returns every day, quotidian fever.

Chapter 170 : Its Symptoms.

Chapter 171 : Its Treatment.

Chapter 172 : On the Cause of the τριταῖος, i.e. the Tertian Ague *(ḥummâ ghibb)*.

A more severe form of it is the καῦσος (in the text mutilated *qawqûs*) or burning fever.

Chapter 173 : Its Symptoms.

Chapter 174 : Its Treatment.

Chapter 175 : On τεταρταῖος, i.e. the Quartan Ague *(ḥummâ rib')*.

Chapter 176 : Its Symptoms.

Chapter 177 : Its Treatment.

Chapter 178 : On ἡμιτριταῖος and the other compound Fevers and their Treatment.

The Author does not know the Arabic term *(shaṭr al-ghibb)* for this semitertian fever, a combination of tertian and quartan fever (fevers with four or five days' interval).

Chapter 179 : On the Causes of the Course *(dawr)* of Fevers, the Difference of their Times and the Cause of the Cold of the Fingers.

Chapter 180 : On Pleurisy *(shawṣa wa dhât al-janb)*, its Symptoms and Treatment. Discussion of the different acute diseases which are associated with fever, frequently attacking young people and prevalent during the Dog-Days (the star *al-Kalb* or *Shi'râ* i.e. Sirius).

Chapter 181 : On Erysipelas *(ḥumra)* and Smallpox *(jadarî)*, their Symptoms and Treatment.

A description of some symptoms of smallpox in two lines only, followed by many recipes.

Chapter 182 : On the Causes of Swoon *(ghashy)*, Sweat *('araq)*, Vomit *(qay')*, their Symptoms and Treatment.

Chapter 183 : On Crises *(buḥrânat)*.

Quotations on the number seven; perhaps from the pseudo-Hippocratic *De septimanis*.

Chapter 184 : On Chapters from HIPPOCRATES the Sage's Book of Prognostics.

Chapter 185 : On Favourable Symptoms in Disease.

Chapter 186 : On the Signs of Death and on Symptoms intermediate between Favourable and Unfavourable.

DISCOURSE XI.

Chapter 187 : On Pain in the Hip-bones *(wirkân)*, Articulations *(mafâṣil)*, Sciatica *('irq an-nisâ)* and Gout *(niqris)*.

Chapter 189 : On Leprosy *(judhâm)* and its Treatment.

This disease is hereditary through contagion of the sperm, and contagious like small-pox and scab. Some kinds of it are called leontiasis *(dâ' al-asad)* and elephantiasis *(dâ' al-fîl)*. Among the remedies is sulphurated water.

Chapter 190 : On Vitiligo *(baraṣ)*, Itch *(ḥikka)*, Prickly Heat *(ḥaṣaf)*, Scrophula *(khanâzîr)*, Eczema *(qûbâ)* and Excoriation *(sa'fa)*.

Other skin-diseases mentioned in this chapter are scab *(jarab)*, wart *(thâ'lîl)*, dry eczema *(raṭy* (29) or *qawâbî yâbisa)*, lice *(qaml)*, dandruff *(bahaq)*, xanthelasma *(kalaf)* and blotch *(sharâ)*.

Chapter 191 : Treatment of these Diseases.

For eczema, powder of sulphur and mercury is recommended. Some superstitious remedies are mentioned.

Chapter 192 : On Tumours (or Swellings, *awrâm*) : Cancer, erysipelas, abscesses.

Chapter 193 : Their Symptoms.

Chapter 194 : On the Treatment of Tumours (Swellings), Gangrene *(âkla)*, Combustion *(ḥirq an-nâr)*, and Contusion *(ṣadma)*. For certain hard tumours excision is recommended, and, as an emollient, pissasphalt *(mûmiyâ'î)*.

Chapter 195 : On the Treatment of Abscess *(khurâj)*, Gangrene *(âkla)*, Bruises *(hashm)* (30) and Plague-boils *(ṭawâ'în)*. Quotation from HIPPOCRATES' *Epidemic Diseases* and narration of his pretended preventive measures against plague.

Chapter 196 : On Dissection *(baṭṭ)* and Anatomy *(tashrîḥ)*.

The author gives in the next few chapters a short and rather poor record of the most important anatomical features. He quotes GALEN's « Anatomy »; it is doubtful whether he follows his

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(29) This term, missing from all the dictionaries, is explained by the Author himself.

(30) Missing from the dictionaries.

great *Anatomicae Administrationes* which existed, about 850 A.D., in ḤUNAIN's Syriac translation, but not yet in ḤUBAISH's Arabic version (31).

Chapter 197 : On the Number of Muscles *('aḍalât)*.

Chapter 198 : On the Number of Nerves *(a'ṣâb)*.

Chapter 199 : On the Number of Bloodvessels *('urûq)*.

No distinction between arteries and veins is mentioned! DISCOURSE XII.

Chapter 200 : On Bleeding (*faṣd*, Phlebotomy).

Chapter 201 : On the Situation of the Blood-vessels and the Value of opening each.

Chapter 202 : On Cupping *(ḥijâma)*.

Chapter 203: On the Rules *(qânûn, κάνων)* of Purgation *(is-hâl)*, its Application and Aims.

Chapter 204 : On Baths.

Chapter 205 : On the Pulse *(majassa)*, from the Books of GALEN and ARCHIGENES *(Arshâjânîs)*. The systolic throbbing of the pulse is called *nabḍ*.

Chapter 206 : On the Differences of the Pulse in every Age and Land.

Chapter 207 : On the Pulse during Sleep, Waking, Hunger and Thirst.

Chapter 208 : On the Pulses in Diseases.

Chapter 209 : From the Books of learned Authors on the Urine *(bawl)*.

These authors are not quoted; one of them is probably MAGNES OF EMESA who wrote a famous book on urine.

Chapter 210 : On the thin white and the thick white Urine. ARCHELAOS (32) is quoted.

Chapter 211 : On the Indications afforded by the thin (Urine) of different Colouring.

Chapter 212 : Indications of thick (Urine) and its Colours.

Chapter 213 : On the oily Colour.

Chapter 214 : On the Deposit *(qâ'im)* in the Middle of the Vessel *(ânâ')*. Another name for the urine-vessel is *qârûra*.

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(31) See M. MEYERHOF, *New Light on Ḥunain b. Isḥâq and his Period. Isis*, VIII (1926), p. 693, no. 21.

(32) This is more likely to be a mis-spelling for ARCHIGENES.

Chapter 215 : On the Sediments *(rawâsib*, Sing. *râsib)*.

Chapter 216 : On the Sheets *(ṣafâ'ih*, Sing. *ṣafiḥa)*.

The description is not clear; the author probably means the formation of a thin film on the surface of the urine.

Chapter 217 : On the bran-like *(nakhâli)* Sediment.

Chapter 218 : On the gruel-like *(sawîqî)*, the sandy *(ramli)* and the foetid *(muntin)* Sediment.

Chapter 219 : Some Quotations from the Sayings of the learned Sage GALEN.

PART V. (p. 355-373), one DISCOURSE.

Chapter 220 : On the specific Properties *(khawâṣṣ)* of the Things.

Aliments and remedies are meant.

Chapter 221 : On the Numbers of Flavours, their Causes and Faculties. Following GALEN, *De simpl. Med. Facult.*

Chapter 222 : On the Action of each Flavour in the Body.

Chapter 223 : On the Smell-scents *(arâ'iḥ*, Sing. *rîḥ)* and their Causes.

Chapter 224 : On the Causes of Colours.

No attempt at optical explanation, but attribution of the colours to heat (burning coal), cold, dryness and moisture.

Chapter 225 : On the Causes of Melting, Consolidation, Combustion, Putrefaction and the like.

Chapter 226 : On the Causes of Drying, Thickening, Splitting and Breaking.

Chapter 227 : On mineral Substances. Probably from PSEUDO-ARISTOTLE.

Chapter 228 : On the Causes of Plants, Trees and Fruits. Quotation from HIPPOCRATES' *De Natura Pueri*.

PART VI. (p. 374-500).

DISCOURSE I. The next chapters contain the names of hundreds of aliments and drugs; I intend to give only those which are rare or of special interest.

Chapter 229 : On Corn-seeds *(ḥubûb)*.

Besides wheat, barley, etc. the products of grain are enumerated, e.g. pounded grain *(harîsa)*, vermicelli *(iṭriyya)*, groats *(jâwris, jâwrish)*, and parched grain *(sawîq)*.

Chapter 230 : On Vegetables *(buqûl*, Sing. *baql)*, Pumpkin *(qar')* and Cucumber *(khiyâr)*.

Worthy of mention are the Syriac name for the wild endive or succory *ṭalakhshaqûq, (Taraxacum)*, *bâdranj-bûya* (Persian for common balm, *Melissa officinalis)*, *kharâdînâ-rûya*, a Persian name for which no explanation is to be found in the dictionaries. *Sarmaj* is a synonym for Persian *sarmaq* or Arabic *qaṭaf*, i.e. orach *(Atriplex hortensis L.)*; *qûniyâ*, probably from Greek κωνία, as a name for « the long kind of melon » (*biṭṭîkh*, probably *Cucumis melo var. chate Naud.*) and the Persian name *râsan* for elecampane *(Inula Helenium L.)*. MÂSARJAWAIH, the Persian-Jewish physician of the VIIIth century, is quoted.

Chapter 231 : On the Faculties of Fruits.

Several of them are such as were unknown to the Greeks, e.g. tamarind *(tamr hindî)*, sebestens *(sibistân*, fruit of *Cordia Myxa L.)* and cocoa-nut *(jawz hindî)*. Sugar-cane *(qaṣab as-sukar)* and the pith of palm-trees *(jummâr)* are enumerated as fruit-aliments.

Chapter 232 : On the Faculties of Meats. Many kinds of mammals and birds and their organs are mentioned.

Chapter 233 : On the Faculties of Milk and Cheese.

Chapter 234 : On the Faculties of Fish.

Special mention of the two Cyprinus-carps *shabbûṭ* and *bunnî (bunnâj)* and the eel *mâr-mâhî* (33).

Chapter 235 : On the Faculties of Oils *(ad-hân)*.

Enumeration of 27 kinds. *Dihn al-khîrî* (Persian) is the oil of yellow gillyflower-seeds *(Cheiranthus Cheiri L.)*.

Chapter 236 : On the Faculties of Wines.

The red wine is said to form blood, astringent wine is good for diarrhoea. Wine as a medium for drugs.

Chapter 237 : On the Faculties of Fruit-juices.

(Persian *afshurajât*, (34) Arabic *'aṣârât*).

Chapter 238 : On Confections (Ar. *murabbayât*, Persian *anbajât*).

Chapter 239 : On Vinegar *(khall)* and Vinegar-sauces *(kawâmikh)*.

Chapter 240 : On the Faculties of Sweetmeats.

Chapter 241 : On Salts and Spices *(abâzîra)*.

Among the latter are the leaves *(anjudân)*, root *(ushturghâz)* and resin *(ḥiltît)* of *Asafoetida* ! The name *kâsham* refers to a kind of lovage *(Levisticum)*.

(33) In the text misspelt *mâ'mâhî*.

(34) In the text falsely spelt *aqsharajât*.

Chapter 242 : On the Faculties of Aromatic Plants, *(rayâḥîn)*.

About 30 specimens, many of them bearing Persian names. So, e.g., the kinds of basil *shâ-isfaram (Ocimum minimum L.)*, *bâdrûj (Ocimum Basilicum L.)* and *faranj-mushk (Ocimum pilosum L.* or a kind of *Zizyphora)*; (see chapter 129).

Chapter 243 : On perfumed Aromatics *(afâwiyyat aṭ-ṭîb)*.

More than 40 kinds, some of them bearing unknown or rare Persian names. So, e.g., *khosraw-dârû* (the lesser galangal, *Alpinia officinarum Hance)*, *falanja*, a kind of cubebs, and *qaṣab fârisî* (« Persian cane »), probably *Calamus aromaticus* (sweet flag).

Chapter 244 : On Garments and Furs. A very short chapter of seven lines only. Several of the following chapters, on the contrary, are very long.

DISCOURSE II.

Chapter 245 : On Simple Remedies and Drugs *('aqâqîr)*.

After quotations from GALEN and DIOSCURIDES follow about 80 drugs with their chief healing properties. The names are partly Greek, Persian and Syriac, just as they remained in the Arabic pharmacology up to our period. Some comments are necessary : *kamâkhartûs* (p. 401) is a copyist's blunder for *kamâdaryûs* which is the Greek χαμαίδρυς *(germander, Teucrium Chamaedrys L.)*. For wild thyme *(ḥâshâ)* the author gives the synonym *ḥâsa* (a popular name ?). The name *anjurak* is the Persian diminutive for *anjura* (nettle); *mu'aṣfar* is probably an uncommon name for *'uṣfur* or *'uṣfûr*, i.e. safflower *(Carthamus tinctorius L.)*; *bûzîdân* is a salep-root (kind of orchis *Orchis Morio L.*?) ; red and white *bahman*, red lichen and white rapontic (35) has not yet been identified for certain; it is said to be the root of *Centaurea cerinthifolia Sibth*, or of *Statice Limonium L.* The name *mughâth* deserves a moment's attention. This is a drug which, until recently, had never been identified, although it is sold in all the drugbazaars of the Near East. It is a white, thick, curved and rugged root, is sold cut in pieces and is used for strengthening women after child-birth. A French physician made it an article of commerce about the middle of the XIXth century. But it was G. SCHWEINFURTH, the great explorer and botanist, who

(35) According to DR. HONIGBERGER, *Thirty-five Years in the East*. London, 1852, vol. II, p. 378.

determined its true nature; it is the root of *Glossostemon Bruguieri* D.C., a *sterculiacea* growing in the mountains on the Irako-Persian frontier east of Baghdâd. Its flower is known by the name of *Revalenta arabica* (36). *Al-jawz-mârak* is an unusual name which the author explains as « the fruit of the tamarisk *(ṭarfâ)* resembling gall »; it is, as a matter of fact, not the fruit but a gall growing on tamarisks, otherwise called in Persian *kazmâzak*. The Persian name *zarrîn-dirakht* (i.e. « golden tree ») designates the orange-tree. Papyrus is used as a fresh plant *(bardî)* and in the form of burnt paper *(qirṭâs, χάρτης)*. The name *shabaṭbâṭâ* is misprinted in the text; it is, according to IBN AL-BAIṬÂR (No. 1281) a Syriac name for a kind of knot-grass *(Polygonum)* called in Arabic *'aṣâ ar-râ'î* (i.e. shepherd's stick). The Persian name *shabâb bahra* seems to stand for the caper-spurge (*Euphorbia Lathyris L.*), the seeds of which are ordinarily called *mâhûb -dâna* or, in Arabic, *ḥabb al-mulûk*.

Chapter 246 : On Resins *(ṣumûgh)* and Substances which are extracted from the Earth.

The author gives for mastic the name *kiyya* (from Chios) : The substances « extracted from the earth » are resins such as asphalt, pitch, naphtha and the like. In the same chapter follows a section on robs *(rub, rubûb)* or inspissated juices of fruits.

Chapter 247 : On Shells *(aṣdâf)*, mineral Substances, Smoke, Ash and Vitriol *(zâj)*.

For gypsum occur the names *jibs* and *jaṣṣ; zanbaq* (« iris ») is a thrice repeated misprint for *zaibaq* (mercury) which is recommended for skin-diseases. Two stones deserve mention : one of them called *saraṭân hindî* (i.e. « Indian crab ») is probably a false reading for *s. nahrî* (crawfish) the ear-stones (otoliths) of which were and are used in Oriental medicine; the other « the stone which attracts paper and resembles the *zabad al-baḥr* » (i.e. « foam of the sea », or the cuttle-fish-bone, ἀλκυόνιον, Halcyonium of the Greeks). Possibly meerschaum is meant.

Chapter 248 : On the Properties of Earth and of Terra sigillata.

Chapter 249 : On the Rectification and Preservation of Remedies.

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(36) A. H. DUCROS (*Essai sur le droguier arabe etc.* Le Caire 1930, p. 127) erroneously attributes this root to the wild pomegranate *(Punica silvestris Tourn.)*.

DISCOURSE III.

Chapter 250 : On the Properties and the Rectification of purging Remedies.

A long chapter discussing the qualities of 47 drugs. The Persian term *turunj* may designate citron or be a bad reading for *turunjân*, balm-gentle. All the other drugs bear well-known names which are to be found in IBN AL-BAIṬÂR's « Book of simple Remedies ».

DISCOURSE IV.

Chapter 251 : On Man.

Medical properties of the organs and excretions of man.

Chapter 252 : On the Utility of the Parts of Horses.

Chapter 253 : Idem of Mules.

Chapter 254 : Idem of Cows.

Chapter 255 : Idem of Asses.

Chapter 256 : Idem of the Ram and Ewe.

Chapter 257 : Idem of Goats.

Chapter 258 : Idem of Pigs.

Chapter 259 : Idem of Dogs.

Chapter 260 : Idem of Camels.

Chapter 261 : Idem of Stags (or Ibexes, *iyyal*).

Chapter 262 : Idem of Lions.

Chapter 263 : Idem of Elephants.

Chapter 264 : Idem of Leopards.

Chapter 265 : Idem of Wolves.

Chapter 266 : Idem of Hyaenas.

Chapter 267 : Idem of Bears *(dibaba)*.

Chapter 268 : Idem of Foxes.

Chapter 269 : On Rats.

Chapter 270 : On Weasels *(ibn 'irs)*.

Chapter 271 : On Hares (or Rabbits).

Chapter 272 : On the Hedgehog *(qunfudh)*.

Chapter 273 : On Hens and Cocks.

Chapter 274 : On Geese.

Chapter 275 : On Pigeons, Turtle-doves *(shifnîn)*, heath-cocks *(durrâj)* and wild (ring-) doves *(warâshîn)*.

Chapter 276 : On the Eggs and Parts of Cranes (or Storks, *laqlaq*).

Chapter 277 : On the Crow *(ghurâb)*.

Chapter 278 : On the Partridge *(ḥajal)*.

Chapter 279 : On small Birds (in general, *'aṣâfir*) and Sparrows *(sûdâniyât)*.

Chapter 280 : On Falcons *(bâzî)*.

Chapter 281 : On the Utility of the Bat *(khuffâsh)*, Swallow *(khuṭṭaf)*, Bustard *(ḥubârâ)* and Hoopoe *(hud-hud)*.

Chapter 282 : On Flies and Locusts.

Chapter 283 : On the Use of Castoreum *(jund-bîdastar)*.

Chapter 284 : On the Crawfish *(saraṭân nahrî)*, Tortoise *(sulḥafâ)* and Skink-(lizard) *(isqanqûr)*.

Chapter 285 : On Glue *(ghirâ)* and Water of Fishes.

Chapter 286 : On Frogs and Leeches.

Chapter 287 : On the Use of Vipers *(afâ'î)* and Sloughs of Snakes *(silkh al-ḥayya)*.

Chapter 288 : On Scorpions and Geckos *(sâmm abraṣ)* (37).

Chapter 289 : On Spiders, Ants and the long Worms which are found beneath Jars and Rubbish-heaps (Rainworms).

Chapter 290 : Description of the Properties of the Gravy of Meat, Grease, Tripe *(infaḥât)* and Feet *(ki'âb)*.

Chapter 291 : On Milk and Cheese.

Chapter 292 : On Curds and Whey.

DISCOURSE V.

Chapter 293 : On Poisons.

Chapter 294 : On the Symptoms and Treatment of Poison[ing].

Discussion of various poisonous things, « hot » poisons like monk's hood, cashew-nuts, spurge, the sting of scorpions, the bite of mad dogs and the like. The author states that, in the mountains of his country (Ṭabaristân), foxes and rats are frequently hydrophobic; he again gives superstitious practices for the prevention of bites of mad animals, and many recipes.

DISCOURSE VI.

Chapter 295 : On Compound Remedies and Theriacs.

This is the longest chapter in the book, comprising 18 pages (p. 449-67). It is full of interesting prescriptions and partly mutilated names of remedies and physicians. The globule *(qurṣ)*

(37) The harmless gecko-lizard has always been and still is considered by Orientals to be poisonous and possessed by the evil eye. As to his medical qualities see AD-DAMÎRÎ's Zoological Lexicon, ed. JAYAKAR vol. II, p. 23, London and Bombay, 1908.

of « Androchoron » (Andromach ?), the *Athanasia*, another prescription by a certain SALÎM AN-NAKARÂWÎ, a *Dabîd* (electuary, Persian term) of Anacardia (Arabic *balâdhur*, i.e. cashewnut), Persian and Greek *falûniyâ* (Philonium, see chapter 90); the *Ayârîj Fîqrâ*, i.e. GALEN's ἱερὰ πικρά, a bitter laxative; a « Caesarian remedy » *(dawâ Qaisar)*, the « great Theodoretus (Dorotheus ? Theodotian ?) remedy », and the *Metroditos*, (i.e. Mithridates) are evidently antidotes of Greek origin. Syriac names occurring are the *kawkebâ* (« star »), the *shalîthâ*, the *dakhmurtâ*, the *sajzînâ* recommanded by YAḤYÂ BAR MÂSAWAIH (d. 857 A.D.) (37a) ḤUNAIN's teacher and the Author's contemporary, *sunûnîthâ* (38) or, in Arabic, *al-khaṭâṭîf*, i.e. « the Swallows » for sore throats. A remedy of the above-mentioned Jewish Physician MÂSARJAWAIH and an electuary *'aṭîyat Allâh* (God's Gift), or, in Persian, *fanjanûsh* (*panj nôsh*, i.e. made up of five remedies), must be mentioned.

Chapter 296 : On Compound Purging Remedies.

Again many Greek names : GALEN's *Ḥabb Qûqâjâ* is a curious tautological name, as *ḥabb* in Arabic and κοκκία in Greek designate grains or pills. *Ḥabb al-Bîmâristân* are « Hospital Pills », perhaps derived from the famous *bîmâristân* (hospital) at Gondêshâpûr, the old Persian Medical School.

Chapter 297 : On Tablets or Globules *(qurṣ)*.

Chapter 298 : On sweet Medicines *(jawârish)*.

Some of them are called after Persian kings, one, e.g. *Shahriyârî*, another after the Khosraws *(al-Akâsira*, from *Kisrâ*, the Arabic name for Khosraw).

Chapter 299 : On Confections *(rubûb)*, Wines *(ashriba)*, « Lily-Wine » *(maisûsan*, Persian, a compound potion), Juice of Quinces *(maiba*, Persian), Oxymel *(sikanjabîn*, Persian), Confection of Mulberries *(rubb tût)* and the like.

At the end of this chapter the Author communicates a preparation of *maisûsan* invented by his father (SAHL RABBAN), a complicated prescription which it requires no less than six months to concoct.

Chapter 300 : On Oils *(ad-hân)*.

(37a) These three names which are missing from the Arabic dictionaries have been explained by HERMANN LEHMANN in Orientalist. Literaturzeitung, 1929, p. 871-3.

(38) The spelling of BROCKELMANN, Lexicon Syriacum (Halle 1928) is, however, *qaṣṣûmîthâ*. The *daḥamûrṭâ* is met with in the same dictionary p. 844a.

Compound oily extracts of different plants.

Chapter 301 : On the Drinking of the Milk of She-asses *(utun)*, Milch-camels *(liqâḥ)*, Goats, churned Milk *(makhîḍ)* and the like.

Chapter 302 : On Unguents *(marhamât)*.

Again several Greek names, moreover an « Unguent of the Prophets », a Basilicum-unguent, and an unguent for scrophula from the author's own experience. An unguent invented by (the Arab warrior and poet) ABÛ MIḤJAN for wounds is described and another one which is said to have been applied by SHÎRÎN the queen of King KHOSRAW. A superstitious practice is described at the end of the chapter.

PART VII.

DISCOURSE I.

Chapter 303 : On Places, Waters and Winds. Following HIPPOCRATES.

Chapter 304 : On Towns and the Conditions of (in which) their Inhabitants (live).

Chapter 305 : On Waters and their Faculties.

Chapter 306 : On the Cause of the Saltiness and Coldness of the Waters.

Chapter 307 : On the Seas and on the Cause of the perpetual Streaming of the Rivers, extracted from ARISTOTLE's Sayings.

Chapter 308 : On the Soils and the Colour and Character of those who live on them.

Chapter 309 : On Airs (Climates) and their influence on the Body.

Chapter 310 : On Winds and their Periods, and on the Indications which they afford concerning Health and Disease.

Chapter 311 : On the Seasons and their mutual Relations.

All the preceding chapters follow HIPPOCRATES' *Airs, Waters and Places*.

Chapter 312 : On Signs in the Air pointing to coming Events.

This chapter is important not in the sense intended by the Author, but because it contains a series of allusions to political events which occurred in the Author's young years. Unhappily he avoids giving names—with the exception of that of the caliph

HÂRÛN (AL-WÂTHIQ 842-847 A.D.) (39)—probably because the kings and princes concerned were mostly Persians, Zoroastrians and rebels against the authority of the caliphs. A careful study of the history of Ṭabaristân in connection with 'ALÎ B. RABBAN'S allusions will perhaps make it possible to throw still more light on the darkness surrounding the time in which he lived.

Chapter 313 : On the Signs of Animals pointing to coming Events.

Quotations from the *Book of Agriculture* (see p. 4). Here ends the excellent Berlin MS. The last 47 chapters have been edited according to the four more recent MSS. only.

DISCOURSE II.

Chapter 314 : The Refutation of the Opinion of those who underrate Medicine.

The Author begins : « Some writers of our time have been led by self-conceit and ignorance of their personal worth to depreciate Medicine, pretending that there is in the things neither utility nor noxiousness to the bodies and to mankind. Those who speak this do not deserve an answer or a requital, as they are like bats and owls to whom the light of the sun is blindfolding and not salutary ». He then argues against the despisers of medical knowledge by citing a great number of efficacious remedies, and by mentioning that even animals know the salutary action of certain plants.

In the following chapters he continues his refutation in a less convincing manner by quoting a great number of popular observations and beliefs, and by enumerating many alleged specific properties of animals, plants anf minerals. The main interest of these chapters concerns folk-lore.

Chapter 315 : On the Properties of Things overcoming the Strenghth of Fire and Ice, and on Things which are influenced one by another.

'ALÎ mentions (p. 525) that he saw at Sâmarrâ a Negro who ate snakes and scorpions, and a red-haired youth who did not

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(39) See my correction of the editor's errors in the Introduction, p. 9. A more detailed study of this chapter will appear in the near future (M. MEYERHOF, *'Ali ibn Rabban aṭ-Ṭabarî, ein persischer Arzt des IX. Jahrhunderts n. Chr.* In *Zeitschr. d. Deutschen Morgenländ. Gesellschaft*, 10, 38-68, 1931).

suffer from the sting of scorpions, but, on the contrary, the scorpions died after having stung him !

Chapter 316 : On the specific Qualities *(khawâṣṣ)* of some Plants which change one another or act as Antidotes to one another.

Mostly extracted from the « Book of Agriculture ».

Chapter 317 : On strange Things concerning the Nature of Animals, Waters and some Trees.

Chapter 318 : On Curiosities about Physicians and some of their Tricks.

About 16 stories of doctors and patients, some of them taken from GALEN's own experiences.

DISCOURSE II.

Chapter 319 : On the Eternity of the Spheres and the Luminous Bodies and their Creation, and that the Creator moves them without being moved Himself.

Quotations from HIPPOCRATES' *Airs, Waters and Places*, from GALEN's commentary on that book and from ARISTOTLE's *Meteorology*.

Chapter 320 : On the Succession of the Spheres and their Contents and on the Difference in their Revolution.

Chapter 321 : On the Movement of the Planets and their Light.

Chapter 322 : On the spheric Form of the Spheres, the Earth, the Sea, their Vastness, the Arguments for it and the Refutation of the Opinion of those who contradict it.

Chapter 323 : On the Distances of the Planets and their Volume. All this following Ptolemy. At the end 'ALÎ gives the Persian names of the months.

Chapter 324 : Refutation of the Opinion of those who deny that these Spheres and the Natures (i.e. natural Features) are limited (40).

DISCOURSE IV : *From the Summaries of Indian Books*, 36 chapters (41).

Chapter 325 : On the Origin of Medicine.

The Author gives an extract from Indian philosophical and medical theory and practice, which is partly in agreement, partly at variance with Greek science. He leaves the estimate as to

(40) A mistake in the text, « boundless ».

(41) See notes 4 and 5 to the Introduction to this study.

which is right to the reader. He extracted his summary from the books of CHARAKA (Arabic : *Jarak*), SUSHRUTA (Arabic : *Susrud*), the Nidâna (Arabic : *Nidân*), and the Ashtâṅgahṛadaya (Arabic : *Ashtânqahradî*).

Most of the 36 chapters on Indian Medicine are very short. On the other hand their contents are in full accordance with our actual knowledge of old Indian Medicine. So I will refer, as concerns the literature, to GEORGE SARTON's *Introduction to the History of Science*, vol. I, pp. 76 foll., 284, 480 foll. and 537, (Washington 1927), and, as concerns the contents, to T. A. WISE, *Commentary on the Hindu System of Medicine* (Calcutta, 1845); to J. JOLLY, *Indische Medizin*, (Strassburg 1901); to R. HOERULE, *Studies in the Medicine of Ancient India*, Part I, (Oxford, 1907); and to G. MÛKHOPÂDHYÂYA, *The Surgical Instruments of the Hindus*, (Calcutta 1913), Introduction. Important is, moreover, A, MÜLLER's essay « Arabic sources on Indian Medicine » (*Zeitschr. Deutsch. Morgenländ. Gesellsch.* vol. 34, 1880, pp. 465-556).

After a short cosmology the Author says that according to Sushruta, the medical science was introduced by DAHMÎṬRÂ (42) who received it from Brahman (BRAHMÂ).

The following chapters are extracted from SUSHRUTA.

Chapter 326 : On the Parts of Medicine.

These are eight in number : 1° the medicine of children, (pediatry); 2° the medicine of the style (for collyrium, *mîl*, i.e. *μήλη*): ophthalmology; 3° the medicine of the body (general medicine); 4° the medicine of the lancet *(ṭibb mibḍa'î)*, i.e. the art of phlebotomy; 5° the medicine of the theriac (treatment of poisoning); 6° the medicine of sexual things; 7° the rejuvenating; 8° the spiritual medicine, this being the art of expelling bad spirits by charms *(ruqâ)* (43).

Chapter 327 : On the Qualities required by the Student of Medicine. Bodily and moral purity are indispensable.

Chapter 328 : On the right Estimate of Treatment and on the Avoidance of Hurry in it. Necessity of exercising the different

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(42) Probably a mutilation of Dhanvantari, a legendary king of Benares and an expert on medical science.

(43) See the eight parts of Medicine enumerated by JOLLY, p. 13, according to CHARAKA, SUSHRUTA and ATREYA.

surgical interventions (probing, cutting, sewing, etc.) on plants or dead bodies of animals, exactly as described by Jolly, p. 20.

Chapter 329 : On the Genesis of Man and on the Generation (Procreation) of Animals.

Four kinds of generation : from the uterus (mankind and mammals), from the egg (birds, fishes), from the earth (Spanish flies [*dharârîh*] and worms) and from dirt (lice and nits.) Then follows a short explanation of the three fundamental humours of the body, viz. wind, gall and phlegm (mucus).

Chapter 330 : On the Genesis of the Embryo and of the Members.

Procreation results from the union of the male sperm and the female menstrual blood. In the uterus the embryo develops blood from the aliments, flesh from blood, fat out of flesh, bone from fat, brain from bone, sperm from brain. The origin of life is the *awj* or blood-drops in the centre of the heart (44).

At the end of the chapter 'ALÎ B. RABBAN cites from the *Nidâna* that the three fundamental humours are called *dûs* (i.e. *dôsa*), the seven essential constituents (chyle, blood, flesh, fat, bone, brain, sperm) *dhâtu*, and the seven unclean excretions *mail* (45).

Chapter 331 : On the Action of these three Humours when they increase or diminish. All kinds of diseases are provoked by this.

Chapter 332 : On the Regulation of Health and the Means applied for this Purpose. Following the *Ashtâṅgahṛadaya;* very detailed prescriptions for brushing the teeth, anointing the eyes, perfuming the body in the morning, very much in accordance with JOLLY's paragraph (46) on this matter. Modification of the diet and regulation according to the seasons.

Chapter 333 : On the Excretions of the Body and the Damage caused by their Retention. Following the *Ashtâṅgahṛadaya.*

Chapter 334 : On the Aliments Excess of which has to be avoided.

Chapter 335 : On Waters.

Chapter 336 : On Flavours and Food-stuffs.

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(44) Probably the same principal vital faculty as that which is mentioned by JOLLY (p. 42) under the name of *ojas* or *bala* and by Wise (p. 37) as *ozah*.

(45) Corresponding to Sanscrit *mala* (WISE p. 55 foll.; Jolly, p. 43). The actual Hindûstânî term for dirt or filth, derived from Sanscrit, is still *mail* (see, e.g. SHAKESPEAR's and PLATTS' Hindûstânî-English dictionaries).

(46) JOLLY, *l. c.* p. 38 foll., WISE, p. 92, foll.

Chapter 337 : On Eating and the necessary Things before and after Meals.

Chapter 338 : On the Things to be eaten with each Kind of Wine.

Chapter 339 : On Wine.

Chapter 340 : On Milk.

Chapter 341 : On Diet in the different Seasons.

Chapter 342 : On Exhortations which I met in their Books and which I extracted altogether.

Chapter 343 : On the Signs of Diseases.

From the *Charaka Saṁhita* and the *Nidâna*.

Chapter 344 : On the Classes of Diseases.

Chapter 345 : On the Knowledge of the Conditions of the Diseased.

Diagnosis by inspection, feeling of the pulse and questioning of the patient.

Chapter 346 : On the Causes of Diseases and the Period in which the Disturbance of the « Wind » *(rîḥ)* is excited.

Chapter 347 : On (the Diseases) caused by the Excess of each Humour.

Chapter 348 : On the Theory of Treatment.

Chapter 349 : On Gasp *(fawâq)*.

Chapter 350 : On Cough *(su'âl)*, its Symptoms and Treatment.

Chapter 351 : On Thirst.

Chapter 352 : On Diarrhoea *(istiṭlâq)* and Consumptions *(sulâl*, sing. *sill)*.

Chapter 353 : On Fevers and their Treatment.

Causes are the three humours, fatigue, wrath, love, fear, lust, sorcery, poisons, etc. No exact descriptions of the types.

Chapter 354 : On the Treatment of Fevers.

Chapter 355 : On letting Blood and arresting the Flow.

Chapter 356 : On the Signs of Slowless or Rapidity of Trespassing or other Accidents befalling the Patient.

Partly superstitious practices for prognosis.

Chapter 357 : On Spirits attacking Men.

The author excuses himself for having extracted this chapter from the books of the Indians. He records that most of the people in the world believe in evil spirits; that the Prophets mentioned Devils and Ghosts *(jinn)*, but that the Greek philosophers always denied their existence.

Chapter 358 : On Purgatives and Emetics and the Treatment of Fevers.

Chapter 359 : From the Books of an Indian Woman (47), on the Cleansing of the Face and on the Treatment of the Orifice of the Uterus.

A series of recipes, probably from a book on Midwifery.

Chapter 360 : On compound Remedies and on strange Figures.

A very difficult chapter, full of mutilated names of persons and remedies. A recipe by « BARHAM AR-RASÂ'INÎ » is probably that of one of the alteratives *(rasâyana)* known in Sanskrit Medicine. I was able to identify the terms *shûnâq (shonaka = Bignonia Indica), balmûl (palwal = Trichosanthes), kashmîzaj (Cassia Absus L.)* and *qandaqârî (kanṭakârikâ = Solanum Jacquini W.)*; ṢIDDÎQÎ the editor corrected some of the names of drugs without giving any explanation, e.g. *pandûk-parnî*, *sâl-parnî*, *parshanb-parnî* and *stâwârî*. The names of other drugs are given by 'ALÎ AṬ-ṬABARÎ himself in Arabic or Persian. A remedy called *salajît* is not to be found in the works on Sanscrit Medicine, another *maḥadayânâ* is probably identical with the reconstituent *medhâjanana* mentioned by JOLLY (p. 58).

The « strange figures » follow at the end; they are the « chess-board-like figures » for the arrangement of remedies. 'ALÎ gives eleven such figures; according to the combination of the drugs contained in the vertical or horizontal columns one or another form of compound remedy (enema, incense, dentifrice etc.) is obtained. I give on the next page one of these schemes as an example.

The last nine pages are filled with recipes for aromatic compounds *(dharîra)* and perfumes *(ghâliya)*, partly bearing Indian names, e.g. *hârmâkaraht*. The last sentence runs :

« End of the book of 'ALÎ IBN RABBAN on Medicine and all the Kinds of Wisdom ». Then follow Muslim religious phrases added by copyists.

The « chess-board-like » scheme for the composition of remedies is very simple : the numbers give the quantities of drachms or lesser weights of each drug, and the horizontal or vertical columns,

(47) IBN ABÎ UṢAIBI'A (*'Uyûn al-Anbâ'* II, 32 line 27), calls her RÛSÎ THE INDIAN.

	Incense (*bakhûr*)	(Pills) for the mouth	Reconstituent for fever	Toothpowder (*sanûn*)	Toothpowder	Toothpowder	Incense
Perfumed fumigation (*dakhana*)	nard 8	cubebs (*falanja*) 11	unguis odoratus 3	sandal-wood 7	aloes-wood 6	artichokegum (*kankar-zad*) 6	odoriferous moss 13
Pills for the mouth	lac 6	costus 5	nard 4	sugar 9	frankincense 10	coriander 3	*sukk* (compound perfume) 3
Embrocation (*ṭilâ'*) for the bath	cinnamon 4	mace 3	cardamon (*qâqulla*) 12	ptarmic 10	odoriferous tree-moss (*ushna*) 7	costus 6	cytisus (?) (*qandala*) 11
Friction (*masûḥ*)	costus 10	nard 11	sweet basil 6	aloes-wood 7	sandal-wood 5	? (*namâ-lîr*) 3	pine-resin (*kirkir*)
Perfumed fumigation	lac 3	ptarmic (*kundus*) 8	sandal-wood 9	costus 10	cyperus-root (*si'd*) 12	aloes-wood 2	cloves 3
(missing)	valeriana(?) (*bâla*) 4	cinnamon 10	unguis odorat. 13	dry storax (*libnâ yâbis*) 17	sweet basil 13	nard 10	costus 6
(missing)	aloes-wood 8	costus 7	red roses 5	mahaleb (*maḥlab*) 4	nutmeg 2	cloves 17	nard 15

the composition of the compound indicated in the top part or to the left.

In the following *glossaries* all terms, unless specially designated otherwise, are Arabic. In the compound or foreign words A = Arabic, G = Greek, P = Persian, I = Indian, S = Syriac (in parentheses).

Entries refer to the numbers of chapters, as everyone who wishes to use the book will be obliged to number the chapters for himself.

(Cairo). MAX MEYERHOF.

A. — *Glossary of Technical Terms*

'aḍal, muscles 197
adara, hernia 156
'ain, eye, evil eye 52
âkla, corrosion, gangrene 149, 194, 195
am'â' (sing. *mi'â'*), bowels 142
amrâḍ (sing. *maraḍ*), diseases *passim*
amrâḍ ḥâdda, acute diseases 76
ânâ', (urine-) vessel 214
arâ'iḥ, see *rîḥ*
'araq, sweat 182
'aṣab (pl. *a'ṣâb*), nerve 198
'ashâ', night-blindness 93
asr al-bawl, ischury 152
âthâr sûd, black scars 101
awj (ojas? I) ; essential vital faculty 330
bâdh-dishnâm (P), erysipelas of the face 102
bahaq, dandruff, white lepra 190
bakhr, ozaena 102
baraṣ, vitiligo, white lepra 190
bathr (pl. *buthûr*), pustule 92, 102
baṭṭ, dissection 196
bawl, urine 152, 209
bîmâristân (P), hospital 296
bughḍ, hatred 48
buḥrân, crisis 183
bukhl, avarice 48
dâ' al-asad, leontiasis (form of leprosy) 189
dâ' al-fîl, elephantiasis 189
dâ' al-ḥayya, ophiasis 77
dâ' ath-tha'lab, alopecy 77
ḍabâb, « mist », dimness of sight 93
daghdagha, tickling 50
dam'a, lachrymation 93
dawâr, vertigo 79, 85
dawî, tinnitus 79, 84
dhât al-janb, pleurisy 180
dhâtu (I), essential parts of the body 330
dhihâb ma'al-waḥsh, retirement through melancholy 79
dîdân (sing. *dûd*), worms 148
ḍîq an-nafs, oppression, orthopnoea 115
dubaila, stomach-ache 118
ḍumûr, atrophy 64
dûs (doṣa) (I), fundamental humour 330
fâlij (G), plegia 107
fasâd, corruption 158
faṣd, phlebotomy 200

fawâq, hiccough, gasp 117, 349
fikra, reflection 47
fi'l, activity, function 8
fuḍûl (sing. *faḍl*), superfluities, residues, excess 23, 50
ghaḍab, wrath 47
gharab, lachrymal abscess 92
ghashy, swoon 128, 182
ghishâwa, « veil », dimness of sight 93
ghudda, lachrymal tumour 92
ḥabb al-qar', tape-worm 148
hadhayân, delirium 79
ḥalq, throat 110
ḥaṣâ, stone (in the kidney or bladder) 149, 152
ḥaṣaf, prickly heat 190
hashm, bruises 195
hayûlî (G), matter 2, 35
ḥibb, love 48
ḥidda, hastiness 48
ḥifẓ, memory 49
ḥijâb, diaphragm 130
ḥijâma, cupping 202
ḥikka, itch, psorophthalmia 92, 190
ḥilm, forbearance 48
ḥirq an-nâr, combustion 194
ḥulqûm, gullet 130
ḥummâ, fever 161, foll.
ḥummâ damm, « blood fever », i.e. chronic fever 167
ḥummâ ghibb, tertian fever 172
ḥummâ rib', quartan fever 175
ḥummâ shaṭr al-ghibb, semitertian fever 178)
ḥumma yawm, ephemeral fever 162
ḥumra, erysipelas 101, 181
ḥusr al-bawl, ischury 152
ibriyya, dandruff 77
iḥlîl, penis 155
iḥtilâm, a) puberty 28
b) evil dreaming 51
ikhtilâj, quivering 50
ikhtinâq, strangulation 158
îlâûs (G), ileus 148
'inaba, staphyloma 92
'inabiyya, uvea of the eye 92
infi'âl, passivity 8
intifâkh, oedema 93
intiṣâb, upright carriage 25
intithâr (al-ashfâr), falling out (of the lashes) 92
'irq (pl. *'urûq*) blood-vessel 199
'irq an-nisâ', sciatica 187
irti'âsh, tremor 106
is-hâl, purgation 203
istiḥala, metamorphosis, transubstantiation 6
istirkhâ', slackening, relaxation paralysis, 102, 117, 152
istisqâ', dropsy 125
istiṭlâq, diarrhoea 142, 117, 352
izlâq az-zar', (sterility caused by) slipping of the sperm 158
jadarî, smallpox 181
jarab, scab, trachoma, (in the eye) 93, 190
jasâ, sclerosis (of the eyelids) 92
jashâ, eructation 48
jawr, injustice 117
jinn, ghosts 357
jubn, cowardice 48
judhâm, leprosy 189
kabid, liver 123
kâbûs, nightmare 51
kalaf, xanthelasma 101, 190
kathîr al-arjul, polyp 102
kazâz, shivering 103
khadar, numbness 50
khafaqân (al-qalb), throbbing (of the heart) 129
khâṣṣa (pl. *khawâṣṣ*), specific property 220, 316
khajal, confusion 46

khalṭ, pl. *akhlât*, humour, temper 71
khanâzîr, scrophula 190
khiffa, levity 49
khurâj, abscess 195
khurûj, outlet 23
khurûj al-mannâ, spermatorrhoea 155
kithrat al-intishâr, satyriasis 155
lahâh, uvula 110
laqwa, facial paralysis 107
al-lawzatân, the tonsils 96, 111
mâ', « water », cataract in the eye 92
mâ' aṣfar, « yellow water », dropsy 125
mafṣil (pl. *mafâṣil*), joint, articulation 187
maîl (I), unclean excretions of the body 330
majassa, pulse 205
maraḍ kâhinî, (psychical form of) epilepsy 79
marâqq, abdomen 79
mibḍa', lancet 326
mîl (G), probe, style for collyrium 326
mirâra, gall 137
mizâj, temperament, mixture 19
muq'ada, anus 157
mûrsaraj (P) « ant's head », a small prolapse of the iris 92
nabḍ, pulsation, systole 205
nafth damm, haemoptysis 134
namsh, freckles 101
nasayân, forgetfulness, amnesia 48, 79
nâsûr, fistula 92, 157
nayyira, luminous celestial body 9
nazaq, fickleness, thoughtlessness 48
nazaf damm al-ḥaiḍa, dysmenorrhoea 158
niqris, gout 187
nûra, depilatory 157
qabḥ ash-shahwa, perversion of appetite 117
qaiḥ, suppuration 96
qâ'im, deposit (in the urine) 214
qaml, lice 92, 190
qânûn (G), rules 75, 203
qara', baldness (partial) 77
qarḥa (pl. *qurûḥ*), ulcer 96, 117, 149
qarḥ al-am'â, dysentery 145
qawlanj (G P) colic 148
qay', persistent vomiting 117, 182
qillat al-mannâ, aspermatism 155
qûbâ (pl. *qawâbî*), eczema 190
qûlûn (G), colon, large intestine 146
qush'arîra, horripilation 50
rabw, asthma 115
raḥam, uterus 158
ramad, ophthalmia 92
râsib (pl. *rawâsib*), sediment 215
râsib muntin, foetid sediment 218
râsib nakhâlî, bran-like sediment 217
râsib ramlî, sandy sediment 218
râsib sawîqî, gruel-like sediment 218
raṭy, dry eczema 190
rîḥ, one of the three Indian vital humours, smell-scent 346
rîḥ al-khuṣiyya, hydrocele 156
rîḥ as-sabal, conjunctival congestion 92
rîḥ ghalîẓ, fluxion, congestion 149
riyâḥ, flatulence 148
ru'âf, epistaxis 99
ruqâ, exorcism 327
rû'yâ, visions 52
sadar, vertigo 85
sadd (pl. *sudud*), obstruction 117, 149
ṣadma, contusion 194
ṣadr, chest 113
sa'fa, excoriation 190

ṣafîḥa (pl. *ṣafâ'iḥ*), film on the surface of the urine 216
saḥj, dysentery 142
sal', baldness 27, 77
sanûn, tooth-powder 102
sanwartâ (S P), cephalalgy 79, 90
ṣar', (spasmodic) epilepsy 79
ṣawt, voice, vocal organs 113
sayalân, downflow, lachrymation 93
shahwa, lust, appetite 47, 117
shahwa kalbiyya, canine appetite 117
shaib, white hair 27
shajâ'a, courage 48
shajja, wound in the head 78
shaqîqa, hemicrania 79
sharâ, blotch 190
shatar, inversion of the lids 95
shatra, symblepharon 93
shawṣa, pain in the chest, intercostal neuralgia 133, 180
sahar, sleeplessness 79
sill (pl. *sulâl*) phthisis, consumption 119, 166, 352
su'âl, cough 130, 350
subât, lethargy 79
ṣudâ', headache 79
ṭabî'a (pl. *ṭabâ'i'*), nature, temper, constitution 3, 72
tamaṭṭî, stretching of the arms 50
tamth, menses 28
ṭanîn, tinnitus 84
taqdimat al-ma'rifa, prognosis 131
taqṭîr al-bawl, stillicidium 152
ṭarfa, bloodspot in the eye, 92
tashannuj, spasm 102, 103
tashrîḥ, anatomy 196
tathâ'ub, yawning 50
tawâḍu', modesty, humbleness 48
ṭawâ'în, plague-boils 195
tha'lîl, wart 190
thanâyâ, central incisors 102
thiql, gravity, clumsiness 49
ṭuḥâl, spleen 140
'uṭâs, sneeze 50
'uqm, barrenness (of uterus) 158
waḍaḥ, white scar 77, 101
wahm, imaginative power 36
waḥsha, shyness, nostalgia 79
wajal, weariness 46
waram, tumour, swelling, 79, 149
(pl. *awrâm*) 117, 158, 192
waswasa, demonianism, melancholy 79
al-wirkân, the hipbones 187
wuthâ, contortion 106
yaraqân, jaundice 137
ẓafara, pterygium 92
zaḥîr, dysentery 145
zahw, vanity 48
zukâm, cold, nasal catarrh 100
ẓulma, dullness of sight, amaurosis 93
zulq al-am'â, « slipping of the intestines », lientery 144

B. — *Names of Drugs and Remedies.*

abzâr, *abâzîra* (sing. *bizr*), spices 241
ad-hân, oils, see *duhn*.
af'â (pl. *afâ'î*), viper 287
afâwiya, aromatics 243
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anbaj, (P), fruit-confection 238
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Letters of an English Physician in the early Seventeenth Century

During the years 1633-1642, JOHN SYMCOTTS, a physician of Huntingdon, prescribed medical treatment for G. POWERS who lived 10 miles away in the village of Ramsey, and, in connection with this treatment, POWERS received letters, bills and directions, of which about 50 pages have been preserved and now form British Museum Additional Manuscript, No. 33464. A selection from them is printed below for their interest to students of the history of medicine.

As a source of information concerning English medical practice in the early 17th century, the SYMCOTTS papers are not worthy to be set in the first rank, alongside the treatises and notebooks of the masters, for the correspondence is but fragmentary and its discussion of the symptoms and treatment of POWERS' disease is of necessity lacking in orderly detail. Yet to offset the deficiencies, the papers have these things in their favor, that they deal with none but medical affairs, and that they give ample material for studying the relations of a country doctor and his patient.

The free use of correspondence by SYMCOTTS and POWERS is itself of much significance, for the rapid sequence of letters in 1633, 1636, and 1641-1642 suggests that correspondence was neither the result of desultory enquiry regarding symptoms, nor a desperate alternative to personal consultation, but an accepted and regular means of communication during periods when consultation could be dispensed with. It is clear that SYMCOTTS saw his patient from time to time (1), and then, perhaps, outlined for him a general course of treatment which in his letters he modified to meet new conditions, as they arose and were described

(1) See below p. 67.

in the letters of POWERS. The length, substance, and sequence of SYMCOTTS' letters prove that correspondence played an important part in his relations with his patient, and point to the conclusion that by full and frequent correspondence the country doctor extended his practice over what was, in proportion to the methods of transportation, a wide area.

This line of action was well suited to the circumstances of POWERS' case. He suffered from a gouty disease, and SYMCOTTS hoped to cure him not by surgery, or any spectacular means, but by special diets which were sufficiently described in letters, and by medicines which were made up in Huntingdon and sent over to Ramsey, with full directions for their use. When blood-letting was recommended, SYMCOTTS left it to POWERS to get local help. In short, there was no cause for urgency, or frequent personal consultation, and POWERS' interests were guarded by his knowledge that the doctor was prompt in attending to letters, was willing to answer hurried calls, and kept assistants to act for him when he was out of town (2).

The arrangement put a special responsibility upon the patient which is clearly shown in the discussion of the treatment of the man whose death is mentioned in the letter of 29 August 1641. There the doctor, having sent out medicine, and directions for its use, was not abashed when POWERS told him that his directions had been followed and soon after the patient had died. SYMCOTTS said that it was the duty of the patient's friends to decide whether he was fit to take the medicine and in defending himself against the suggestion that he lacked skill, sagely remarked concerning the man's death, « God's will is done, not mine ». (3) SYMCOTTS gave a like discretion to POWERS, for he says, at the end of a full description of the treatment he recommended for him, « if I had thought that your toasts, or your spare diet had been sufficient for so great a cause, I had spared my pains; which I write not to move you to take, but to show my purpose and intent therein » (4).

The looseness of this relationship was not without advantages for POWERS. In distant Ramsey he was free to turn his back

(2) See below pp. 73, 77.
(3) See below p. 74.
(4) See below p. 72.

on medical science and to flirt with astrology, to consult a local doctor, or to weigh the merits of SYMCOTTS' advice against that of his friends and of his medical book by VAUGHAN. (5) He was independent; and the doctor took notice of the fact. SYMCOTTS spoke contemptuously of the « wandering physician », « your doctor there », and said of his advice, « I like it not. Such rowelling, drawing and slabbering smells too much of his barber's shop, from whence he went out doctor ». (6) On the other hand, he took a good deal of trouble to explain the nature of the treatment which he himself recommended, to set forth his knowledge of POWERS' disease, and to mention his success in handling similar cases. It is typical of him that after giving full account of the causes of gout, and then excusing himself from further discourse, because « I am so called upon by others this busy day », he must yet go on with a paragraph or so to explain « how the case stands ». (7) All his letters are of this kind and they show him to have been not a garrulous man, but one who lacked authority over his patient and therefore had to present his recommendations for treatment in a reasonable and persuasive manner.

SYMCOTTS performed this part of his task with skill of argument and lightness of touch which are well brought out by way of contrast to the insinuations of his assistant, FULLWOOD, and the frankness of assistant JOHNSON. (8) His discussion was so full and informal that sometimes it gives us a glimpse of the doctor and his assistants in Huntingdon, seeing patients and writing letters, or traveling on horseback in the surrounding countryside to attend the more urgent cases. And a glimpse of POWERS too, sparing of thanks and fees, ever ready to complain, and full of symptoms.

SYMCOTTS' knowledge of POWERS' diseases and his plans for its cure also stand out in sufficient clearness to be mentioned, if not to be closely studied. The nature of the disease is indicated by the continual discussion of gout, and by the phrase, « gout,

(5) See below pp. 63, 65, 66, 68, 69.

(6) See below pp. 68, 69.

(7) See below p. 66.

(8) Perhaps as a means of displaying his knowledge FULLWOOD liked to suggest to POWERS the possibility of an attack of palsy or apoplexy. (pp. 67, 70.). JOHNSON's masterpiece is on p. 77.

of which kind your disease is, though it hath another name, from the place where it is decumbent » (9). To explain the cause of gout SYMCOTTS first described « the serous watery humour », or the « matter of urine », « (which dilutes the mass of blood and by his tenuity makes it apt to be carried from place to place) ». Of this humor, when it had become « unnaturally salt and sharp », he said, « now in case natural heat be languid and decayed, (as in age it must needs be) it becomes lodged in some sensible part, as among the nerves, muscles and membranes, and there by his unkindly qualities causes exceeding anguish » (10).

The physician's task was to assist nature to disperse the humor, and for that purpose SYMCOTTS outlined a system of treatment, under three heads; « 1. the mitigation of the pain where it is extreme, in which case the symptoms must be respected before the cause; 2. the expurgation of the morbifical cause; 3. the corroboration of the affected part. » His amplification of the second section was most complete. « The principal and main remedy curative and preservative (in a fit body) is a vomit; 2. bleeding, for this disease hath his foundation in the blood; 3. purging, according to the diversity of the peccant humor; 4. things (diuretical to move urine, diaphoretical to move sweat) to purify the blood; 5. to resolve and derive the impacted matter by plaster and issues; lastly, to strengthen the parts weakened and enfeebled by the decumbency of a malicious matter » (11). He made no formal recommendations for restoring the patient's general health, but it may be assumed that his remarks concerning diet had this in view. SYMCOTTS knew the virtues of a moderate and simple diet and was specific in his advice on meats and « diet drinks ». He turned to « nourishing things » when the season was « not propitious to eradicative physick ». (12)

SYMCOTTS' knowledge of gout and plans for its treatment, as they are displayed in these letters, suggest the major criticism that he lacked basic principles of treatment. His theory of the cause of the disease was simple and plausible, in contrast to the variety and dissociated character of the means of cure which

(9) See below p. 66. There is a less definite statement on p. 63.
(10) See below p. 65.
(11) See below pp. 63-64.
(12) See below p. 75.

he recommended. This may be seen by a comparison of his words with those of his countryman, SYDENHAM, who, writing about 40 years later, and using the same theory of humors, went on « in gout... the cause is a change and new nature of the system... For years together a man has drunk and feasted—has omitted his usual exercise—has grown slow and sluggish—has been over studious or over anxious—in short, has gone wrong in some important point of life. Now no sensible man can believe that any light and momentary change can remedy this. The system must be transformed. The man must be made anew ». To this end there must be undertaken a gradual strengthening « of the digestion and restoration of the parts », by the use of diets and moderate exercise. (13)

SYMCOTTS did not approach this vision, but some of his shortcomings may be excused on the ground that he was not writing a treatise and the rest may be justified because they represented the orthodoxy of informed medical science in England prior to the work of SYDENHAM. SYMCOTTS was a country doctor, well trained, but trained at a time when the branch of medical knowledge which he here discusses lacked co-ordination. SYDENHAM was the enunciator of basic principles, the English Hippocrates.

SYMCOTTS' orthodoxy in relation to the medical practice of the time must not be too boldly asserted, because it rests on no other evidence than the probability of his having received an orthodox medical education. Among the records of Cambridge University there is mention of one JOHN SIMCOTES, son of JOHN SIMCOTES of Sutton, Bedfordshire, who was admitted pensioner of Queens College, April 1608, matriculated, 1610, Bachelor of Arts, 1611-1612, Master of Arts, 1615, and Doctor of Medicine, 1636. (14) He is the only trained physician of the time who is eligible for identification with the writer of these letters, and the likelihood that this was one and the same person is strengthened by SYMCOTTS' contempt for the untrained doctor, and by the social standing of his patients. POWERS must be passed by, because we have no record of him, but the ST. JOHNS who are referred

(13) THOMAS SYDENHAM. *Works*. London. 1850. Ed. R. G. LATHAM. Vol. II. pp. 140 et seqq.

(14) VENN J. & VENN J. A. *Alumni Cantabrigienses*. Cambridge. 1927. Part I. Vol. IV. p. 76.

to in the letters belonged to one of the first families in the county. (15) And so did another patient.

In Sir PHILIP WARWICK's *Memoirs of the Reign of Charles I. &c.*, there is a note to this effect, that when he was in Huntingdonshire, « after the rendition of Oxford », (1646), « I had occasion to converse with Mr. CROMWELL's physician, Dr. SIMCOTT, who assured me that for many years his patient was a most splenetick man and had phansyes about the Cross in that town (Huntingdon) and that he had been called up to him at midnight and such unseasonable hours very many times, upon a strong phansy which made him believe he was then dying ». (16)

If these letters had no other usefulness they would still serve to show that, assuming the truth of WARWICK's words, this important information regarding OLIVER CROMWELL's health came from a man of sobriety and industry. For such was JOHN SYMCOTTS. (17)

Ad. MSS. 33464. F. 1.

Good Mr. Powers,

I am glad your purge wrought so kindly, whereby nature was enabled to disburthen the principal part of such a violent and virulent humor, and though it be painful to you yet it is better your knees feel the burthen than either your head or liver, from one of which fountains that sharp humor now must needs proceed. Whatever your neighbors ignorantly talk against physic your own judgment can inform you that for the easing of so p... a part, the voiding of the humor by blisters had been improper, and... applied for mitigation might easily repel that vicious humor unto the noble parts, with which course many curing an outward pain

(15) NOBLE M. *Memoirs of the Protectoral House of Cromwell.* Birmingham. 1787. Vol. II. pp. 13 et seqq.

(16) London. 1702. p. 249.

(17) There is further suggestion of SYMCOTTS' association with CROMWELL in the fact that from 23 June 1647 to 12 March 1660 he was frequently named by the commonwealth and protectorate governments to serve on commissions for the regulation of financial, military, and other public affairs in the country of Huntingdon. See *Acts and Ordinances of the Interregnum.* 1642-1660, C. H. FIRTH and R. S. RAIT, 3 vols., London, 1911, vol. 1. pp. 967, 1084, vol. 2. pp. 36, 300, 468, etc. to 1433. GERVASE FULLWOOD, SYMCOTTS' assistant, is often named in the same commissions.

kill themselves, but now the inward parts being secured, outward remedies may safely be applied, and you shall see with a little time and patience all will do well. For their conceit that tell you that the gout is incurable, who knows not that it is only true of an inveterate gout which has become knotty, and that first is as curable as a tertian ague and that by bleeding and purging. Your diet drink is to be your ordinary beer at meals, and between meals I would not willingly have you drink either this or any other. Your leanness is, I hope, from loss of humors, not of flesh. If your pain be extreme send word and I will direct something to quiet the same, otherwise those things which you have already will do well. Thus in much more haste than you, I hope, are in pain, I rest and ever will,

Your affectionate friend,
JOHN SYMCOTTS.

June 1. 1633

Ad. MSS. 33464. f. 2.

Good Mr. Powers,

I am glad to hear you are of the mending hand, and for that symptom of dizziness (which necessary follows evacuation, either by way of bleeding, or purging, or expense of spirits by reason of pain) you may conceive it comes from the attractive faculty of the parts endeavoring to fill up that vacuity, which yet is in the whole body, and by that means sucks up even those watery humors which in the common ways serve for humect..., your stomack and mouth by sympathy feel that sense of thirst. For your relief in that case I would not altogether bar you (for a time) drinking in the morning and between meals, until the emptiness of the parts be a little more satisfied, of such beer or ale as you were wont to take. But for a most effectual course take of this following julep for that intention which will cool in little quantity and so can afford but little superfluity to feed that offensive humor which hath been so troublesome to you. Take three pints of fair water, boil therein, till a pint be wasted, of bruised currants one ounce, of rasure of hartshorn an ounce, three figs sliced, six raisins solis, of cinnamon 20 grains, four prunes of China cut, one dram. Strain it gently and keep it in a glass close stopped. Take of this water four spoonful and add to it of syrup of lemons

one good spoonful, or somewhat more, and take it in the morning first and again about three or four o'clock in the afternoon, so much more, provided that you decrease the quantity of the syrup of lemons as your thirst and heat decays, and, when you can, abstain from this, or other drink, between meals, as I said before. For Mr. Fullwood I can assure you his determination was to have seen you when he went to Upgood, where, having stayed longer than his purpose was, he was constrained to take the next way home again, whither he came not till eight o'clock at night. So with my best love I rest,

Your affectionate friend,
JOHN SYMCOTTS.

June 5. 1633.

I pray abstain from cheese and cheese curds and such obstructive meats for a time.

Ad. MSS. 33464. f. 3.

Sir,

The want of the figs is not of that consequence that the cooling drink should not be made without them, they are good, not necessary and indeed are not to be had with us. I would not have you resolve against drink between meals for you may offer violence to nature and suffer an unprofitable thirst. If you can conveniently only, I wish you to forbear. For the quantity of your diet drink, you must not be curious in regard of itself, but in respect of his operation on your self. It is purgative to you (which I conceive is astringent in others, for what (makes?) sweat and urine is of a binding nature) and the thin humors which it moves are (moved?) inward to the bowels not outward (as it seems) therefore take the less (of it?) at meals and make a supply with other well brewed beer. So you may drink about half a pint in the morning and half a pint at meals for your... draughts, then of other to such a quantity as satisfies nature. The f... of your mouth shows some unnatural heat in the liver still, so doth the whiteness of the tongue, the dryness of the roof of your mouth. Therefore use the cooling draught till you find amendment of these, in that order that I directed. The syrup of lemons is greatly cooling and opening. Use stewed prunes at your pleasure. For your drink, in a word, abstain as much as maybe from satiety, so eat

that you rise with an appetite, avoid meats over much powdered which make gross humors and such as are rheumatic, fish, milk, curds, pork, fen fowl, duck, goose, etc. Bread and butter in the morning will do well, mutton and broth at dinner, but roast is better, for your body is apt to make watery humors; but I will not discharge you from broth and cawdells till your body be a little better repaired, then I shall, except sparingly. Your friends that tell you this will not cure you, full little know what your case had been by this time, if you had not taken this course you have done. A decumbency of sharp humors might easily have bereft you of the use of your limbs long before this, in such a case as yours, which is not properly the gout, as they imagine. If you be so exceedingly fallen in your flesh it will not be amiss to take cock-broth, China broth, hartshorn jelly and such like. So with my best love unto you

in haste, I rest,
Your loving friend,
JOHN SYMCOTTS.

June 8. 1633.

Ad. MSS. 33464. f. 4.

Good Mr. Powers,

The council of your two friends I approve of, to be careful of that pain in your neck, for fear of the inconvenience that may come thereby, not to the neck (as they conceive) but by translation to the shoulder blade, or some more noble part, as the lungs or liver whereby some have been phthysical, some hydropical, in others hath turned to the palsy. But let this not fear you, for such terrible symptoms are not the attendance of a tolerable but a raging pain, when the serous humor of the blood (the matter of urine and cause of your disease) becomes extremely salt, by a permixtion of adust (18) unkindly humor which all grant to be, even in the mass of blood in an unhealthful state of body. I need say no more of the cause, having often touched it heretofore, nor of the manner of the cure which I referred to these three heads; 1, the mitigation of pain where it is extreme, in which

(18) Adust, scorching or dry.

case the symptoms must be respected before the cause; 2ly, the expurgation of the morbifical cause; 3ly, the corroboration of the affected part. In your case there is no necessity to begin with the first, for that your tolerable pain will admit of a regular course. The principal and main remedy curative and preservative (in a fit body) is a vomit; 2ly, bleeding, for this disease hath his foundation in the blood; 3ly, purging according to the diversity of the peccant humor; 4ly, things (diureticall, to move urine; diaphoretical, to move sweat) to purify the blood; 5ly to resolve and derive the impacted matter by plaster and issues, lastly to strengthen the parts weakened and enfeebled by the decumbency of a malicious matter. At this time of the year wherein there is no fear of extremity, I shall make choice but of some of these which make the least alteration in your body. I could wish you would open the liver vein of the contrary ...to seven ounces, a small quantity of ill blood can be no prejudice to you at all, your liver will make as much in twenty four hours space, and much better than that which is let out; 2ly, to strengthen the brain I have prescribed a quilt of sweet powders to be worn continually, especially on the night, and morning, and evening. An electuary of mithridate to serve that intention, dry up rheums, help concoction, repel wind and open the liver. 3ly a diet drink (you may call it sage ale) to drink at meals and otherwise as before to move urine and to further the insensible transpiration of the matter, and serves many more good purposes. For the pain in your toe and finger take this medicine. Beat yolks of raw eggs with twice as much black soap in a dish so long till the soap hath lost his color, with fine flax apply it as a plaster for three or four days, if the pain cease not sooner. To your neck apply that which you have from Mr. Fullwood. So with my kind love unto you and Mr. Sharpe. In haste, I rest,

Your assured loving friend,
JOHN SYMCOTTS.

July 5. 1633.

Ad. MSS. 33464. f. 6.

Sir,

I am sorry for your bearing an unnecessary pain by forebearing the use of the plaster, which might have been safely laid on today,

notwithstanding your skill in the passage of the sign (19) which (for anything I know) is nowhere else to be found, but only in the Almanack. The ancient co... of it is but a fancy, and the ominous events thereof either lies or false positions. Therefore put it on as soon as you can to put away your pain. The worst sign I hear of you is your much sweating, that is a sign indeed of plenty of superfluous humors which nature would be rid of. You did ill to give fuel thereto by your Upgood voyage, where (I guess) the pledging of others' healths endangered your own. Your forebearance herein will save nature that labor of expulsion. For your diet drink it seems your brewer was in fault, but the butcher his report was from himself, not from us, I assure you. I think the best way to mend will be to put on new barm, whereby the beer will be secured from the air. So in haste, with my best love I rest,

Your faithful friend,
JOHN SYMCOTTS.

July 15. 1633.

Ad. MSS. 33464. f. 7.

Sir,

The crick of your neck, the pain of your toe, the swelling of your knees, and the trembling of your joints which you call the palsy are all from one and the same cause. The hotter temper of your liver is not only the fountain of the hot and sharp humor of choler surcharging the mass of blood, from which come that preternatural heat which you feel, but also that the serous watery humor (which dilutes the mass of blood and by his tenuity makes it apt to be carried from place to place) is unnaturally salt and sharp which, being an excrementitial part of the mass, is from the same separated and voided by urine, by sweat, or insensible transpiration. Now in case natural heat be languid and decayed (as in age it must needs be) it is lodged in some sensible part as among the nerves, muscles and membranes, and there by his unkindly qualities causes exceeding anguish and pain.

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(19) The astrologer's sign. In a note to another letter, which is not reproduced here Powers says, « This physic I took in dog days, the sign in Virgo ». Ad. MSS. 33464. f. 26.

From hence come sharp headache, the squincy, pleurisy, backache, the sciatia, joint sickness and the gout, of which kind your disease is, though it have another name from the place where it is decumbent. The weakness of your stomach is from pain of other parts which by sympathy affects the stomach; but I am so called upon by others this busy day that I cannot proceed in discourse. You see how the case stands; your pain of your knees is from an inward fountain, if by plasters you break this swelling before sharp humors be voided otherwise, that part may unhappily gangrenate, if not, yet I think a very improper way to void humors by a solid part, where there is no patent way to convey humors by, whereas they may be carried speedily and safely by the common drain of nature's, by gentle purges. I have therefore prescribed you a regular course which, if you follow, I make no question but your author Vaughan (20) his prognostic (will prove?) vain and frivolous. Thus in haste, with my best love, I rest,

Your faithful friend,
JOHN SYMCOTTS.

Ad. MSS. 33464. f. 8.

Mr. Powers,

I have received according to your letter twenty three shillings and six pence, and have crossed the book. Your diet drink will be best to be drunk continually, as well at meals, as betwixt, (if it purge you not, as I know (no?) reason it should) as your ordinary drink, yet you need not stand so strictly upon it, but that you may sometimes at meals drink a cup of ordinary beer if you have a mind, or the diet drink displease you; but drink of it altogether if you like it, for that is best. After you have worn the plaster on your neck 4 or 5 days, you are to begin to bathe with the juice of bryony morning and evening, and then lay on the plaster no more. For the pain in your neck, it seems the matter hath decumbence there, and thence falls down a little to your shoulders, but I hope by the use of these means which are directed and the help of nature it will be in time discussed

(20) Perhaps, *Natural and Artificial Directions for Health etc.*, by Sir WILLIAM VAUGHAN, London, 1600, and frequently re-edited in the early 17th century, or the same author's *Newlanders' Cure*. London, 1630.

and wasted, and so also the pain (which comes only from distension of the membrane and sharpness of the matter) will cease. Mr. Symcotts doth not fear any dangerous palsy in you, though indeed such causes as are in you may easily produce a disposition that way, but he hopes to prevent the process and danger of it. Your spitting is good for you and he would not have it stayed by any means.

We shall be glad to see you at Huntingdon. Mr. Symcotts thanks you for your token and desires you will excuse his silence at this time, he being not greatly well, besides in a little earnest business at this instant. With my best love remembered, praying for your health and ease, rests your assured friend,

G. FULLWOOD.

(The following directions may belong here.)

Ad. MSS. 33464. f. 9.

Dissolve the things in the brown paper in 3 quarters of a pint of new milk over the fire and being blood warm administer it as a clister this night.

Tomorrow morning fasting, take all the purging potion in the glass, warm, and, about 2 or 3 hours after, take a little thin warm broth and after that a little more broth, now and then as it works, keeping warm and forebearing sleep and cold drinks until supper time: shake it well when you pour it out to take, and be sure to take all the bottom. When you have taken it wash your mouth with a little vinegar and smell the vinegar a good while after.

The same night to bedward, swallow down all the cordial pill in the little box, and so dispose to sleep.

Take a pint and a half of milk and steep in it some mallow and violet leaves being... and small, then add to it as much crumbs of bread as, with good store of boiling, shall make it into a poultice.

Before this poultice be applied, take some of the inward bark of an elder tree, and bruise it and cut it, that by crushing of it in a cloth you may get out some of the juice, in which juice a

little wool being first warmed then put it into the pained ear, and after this apply the poultice upon the pained place and bind.

Break off a little piece of the myrrh in the... and hold in your mouth often, a good while,... and swallow down the spittle, as it...

Ad. MSS. 33464. f. 11.

Good Mr. Powers,

I am sorry for your case, the rather because this effect becomes habituate and in a part that will admit of no violent course. For your doctor his (21) advice I like it not, such rowelling, drawing and slabbering smells too much of his barbers' shop from whence he went out doctor. These are remedies never to be used till the whole body be well rectified, not by a mad evacuation of humors, but a restitution of the temper, otherwise such means will soon cause a greater confluxion of humors and a consecution thereof. I have given directions to Mr. Fullwood (as compendiously as may be for such a case) for two purges, plasters, diverting and staying of the rhu..., strengthening the weak part etc. All of which must be done in order successively, or all is nothing. If this course now prescribed be not sufficient, let me hear again of you, for your veins are cloyed with waterish humors and that which now troubles your eye, threatens your knees and feet except it be prevented, yet had better be there than where it is. Thus in haste, with my kind love to you, I rest,

Your very loving friend,
JOHN SYMCOTTS.

Huntingdon
Dec. 13, 1636.

MSS. 33464. f. 10.

Good Mr. Powers,

Because this effect proceeds from accidental distemper rather than any natural affluxation of humors, it had been good to have opened a vein, but neither your years nor the time of the year are propitious, therefore if you have any disordered heats, I advise you to use of barley water made with licorice, anise seeds etc.

(21) See below p. 69.

I have directed you some things now, not physical (as that word is commonly taken) but only to rectify the serous humor and void it by urine, which is the intention of the pills to be taken at nights. I love no much tempering with things to be blown into the eye, but now white sugar candy used as you mention can do no hurt, therefore you may be bold with it. I hear your doctor there is much offended with me for inveighing against him. I pray stop the rumor. I assure you I have been ever silent in the censure of wandering practioners and so of him, but for a few words I inserted into a letter to you. I suffer such to weary out themselves. I think him worthy of contempt, not of opposition which would make the world think there were something good in him that might disadvantage me. Let him therefore not think of me, as I do not of him, being neither sorry for his stay nor glad for removal. Thus in haste, with my kind love to you, I rest,

Your very loving friend,
JOHN SYMCOTTS.

December 20. 1636.

(In G. Fullwood's hand)

Bathe your eyelid with the water in the glass oftentimes in the day at your pleasure, and now and then you may drop a drop or two into your eye, especially to bedward and every night to bedward swallow down two of the pills in the box, and so rest. And every morning fasting, and also about half an hour after meals, eat so much of the powder in the paper as you can take up with a shilling. Also use your white ointment yet sometimes, as before.

Add. MSS. 33464. f. 12.

Good Mr. Powers,

Your high colored urine is an apparent sign of inflamation of blood and multitude of choleric humors, which (nature not rightly disburthened of by the common ways) are carried upwards, fixed in the bordering parts of the brain, cause that pain, noise, and impostumous matter which you complain of. My advice is that (notwithstanding your clymacterical year and your not taking of physic hitherto) you suffer not ill qualified, hot, choleric

humors to become masters over nature, but dispose them downwards by such part as nature hath assigned for evacuations of humors by, then you may safely use local remedies to the place of pain which before will be improper,—the fountain not being taken away—and your sudorifical lemon posset drink may do some good. Otherwise sweating before purging will but draw the humor in the 1st and second region into the 3d and habit of the body, and you shall go about to void a multitude of matter by the pores and solid parts. I would have you take a clyster this night, tomorrow morning to purge, then to take something to apply to the pained parts. Let me hear how this doth and I will advise further. I am in extreme haste and can write no more now, but rest,

Your very loving friend,
JOHN SYMCOTTS.

Ad. MSS. 33464. f. 13.

Mr. Powers,

The doctor is from home. If your other (eye?) grow worse and worse, it would be... with that as with the other, I mean purging, but in the meanwhile apply the white ointment often to it, as you were formerly directed for the other, which, perhaps, may suffice of itself, without more ado. I have sent here a box of it more, lest you should have none left. If it will not do, send to the doctor again. You might do well also to apply to your temples and forehead the same emplasters you did before to them also. And be sure to keep light from it, and take heed of wines and hot drinks, and also of drawing the matter backward into the neck, lest a worse thing follow, haply an apolexy or palsy. Thus much in extreme haste, from

Your most sure friend,
G. FULLWOOD.

Hunt. 6 *January* 1637.

Add. MSS. 33464. f. 14.

(In Powers' hand). When my left eye was sore inflamed. A bill for Mr. Powers, Dec. 14, 1636.

	(£.s.d.)
A purging potion with syrup rhubarb etc.	0. 1.6.

A cordial bole for 4 doses	o. 1.2.
Two plasters for his feet	o. o.8.
Venice turpentine	o. o.3.
Powders for a plaster for his temples	o. 1.2.
4 purging pills	o. o.6.
A purging powder	o. o.1.
A purging syrup pot	o. o.5.
White ointment	o. o.4.
An electuary with mithridate i. etc.	o. 2.4.
20. Water for the eyes	o. o.5.
A bowl for divers nights	o. o.6.
A powder for divers times	o. o.7.
Jan 8. A white ointment box	o. o.6.
	o.10.9.

(In Powers' hand)

Paid this bill to Mr. Fullwood's young man the Quarter Sessions day, being the 18th of April 1637.

Ad. MSS. 33464. f. 19.

Good Mr. Powers,

I am in haste yet I will not grudge to give you a short account of my intention in the late prescribed course. Considering the symptoms laid down before my eyes I found some proper to the scurvy, other peculiar to the old gouty humor which whirls about and if you look not to it may fall upon some inward part as the stomach, guts, sides, etc., or unto your foot, as very lately upon my old father (before that, as healthful a man as lived) and that so suddenly that in 3 days it corrupted so his foot to the bone that daily deaded and putrified parts of bones were taken out. I spared not his age, 77, but advised bleeding and purging above 40 times in less than 7 weeks space, or he had been in his grave. I conceived your humors might be sharp, fritting in your foot as they had been in your eye, that it was better to intercept them than suffer them to fall into a solid part, unapt to void them being once received. I thought upon your clymacterical, wherein you purged much and was twice let blood with no disadvantage to nature at all. I could not but think that humors of this nature grow every day worse and worse,

and therefore directed a few purgatives to be infused in some of your best Ramsey ale for 3 days, and then to take of it to work 3 times a day, without any curiosity of diet or staying within doors, and then I directed local remedies for the pain propounded. If I had thought that your toasts (which lock in the humors) or your spare diet had been sufficient for so great a cause I had spared my pains, which I write not to move you to take, but to show you my purpose and intent therein. My letter has done his errand, and I rest, as I ever shall,

Your very loving friend,
JOHN SYMCOTTS.

June 15. 1639.

Ad. MSS. 33464. f. 23.
2 June 1640.

Good Mr. Powers,

I am sorry to hear you are so ill. The doctor is not yet come home. I perceive you desire not now to forslow time any longer and therefore I have presumed to send you something, though but a little (for present, till I can speak with the doctor) and that very easy. I conceive you have absolute need of purging (which indeed should have been done long ago by the doctor's direction) and I have sent the most gentle thing we have, namely, a little leintive electuary (in the pot) for 3 times, 3 several mornings. Take about the third part each morning fasting, and 2 hours after a little thin warm broth sometimes, as it works keeping warm. And each night to bedward take about the third part at once also of the cordial bole in the less box and so compose to rest. It is only comfortable and strengthening of the stomach. Also to facilitate your raising of the phlegm, and to thicken it, lick often of the lohock in the bigger box, at your pleasure, holding it in your mouth till it melt down of itself. When the doctor comes I will show him your letter, and, if he think anything further requisite for you, you shall not want the best supply in the power of

Your true friend,
GERVASE FULLWOOD.

(In Powers' hand).

This physic put me to intolerable pain and gripings in my breast, back, stomach, and sides; the gout took me in mid May 1640. The black soap and yolks of eggs made the top of my foot swell and to itch exceedingly. I rubbed them, they rose in blisters and issued water exceedingly; at last I applied cowdung, vinegar, and butter poultice-wise, as hot as I could endure, at 4 times dressing the heat.

2 *June* 1640.

Ad. MSS. 33464. f. 25.

Sir,

I have now at length spoken with the doctor for you and he wishes you still to purge a little more. And for this purpose we have sent you by his directions 3 purging pills in the middle box, which he desires you to take on a morning about 6 of clock all at once. Swallow them down in anything you can best and 2 or 3 hours after take a little thin warm broth sometimes, as they work• keeping warm within the house. And that night to bedward to swallow down (without chewing) all the cordial in the least box and so to rest. Also to spread the mithridate in the bigger box, upon the leather bound with it and so apply it to the pit of the stomach, a little above the navel, and bind it on 3 or 4 days. Lay it on at night to bedward, after the pills. Also to drink a little draught of wormwood wine, (or claret wine, wherein a little dry wormwood hath been steeped 12 hours at least, in a stone jug close stopped) about half an hour always before meals. So with my kind salutes, praying for your good health, I rest,

Your most assured to his power,

GERVASE FULLWOOD.

8 *June* 1640.

(In Power's hand). This physick did me much good.

Ad. MSS. 33464 f. 27.

Good Mr. Powers,

I no sooner received your letter but presently caused my horse to be made ready for Ramsey and suddenly was stayed by the second messenger. For your satisfaction, concerning my prescription of a vomit, it was this. I saw his water was very thick

and yellow which intimated the great oppression of his stomach and heat of liver which had made so much choler... bleeding was too late and so I thought most convenient to clear his stomach by a gentle vomit (which God is witness was the same I often gave to my lord St. John) and to give him things to dispose to rest, which before had been no better than... Whatever procures sleep, stays the motions of humors and so I had against... judgment been injurious to nature. I made choice of the former as the more... and secure way and so had been, if Nature had not been utterly spent in him. The physick seems to (have) had a hand to accelerate his end which was at hand before. I think they that were present might easily have judged if he had had strength enough to take a vomit or not, and, in case of so great weakness that was upon him, to have foreborne. But so it was not God his good pleasure and therefore I must be content his will be done, not mine. Remember by humble service to Sir Oliver, and so I rest,

Your very loving friend,
JOHN SYMCOTTS.

Aug. 29, 1641.

(The following notes are added in Fullwood's hand.)

For Mr. Powers.

Every 3 or 4 hours the doctor desires you to take half a spoonful of the pectoral syrups in the square glass. You may lick them with a licorice stick (if you please) and let them melt down by degrees. About an hour before meals take a spoonful of the opening syrups in the round glass so long as they last.

(In Powers' hand.)

29 Aug. 1641. For my hoarseness of speech, which did me good.

Ad. MSS. 33464. f. 31.

Good Mr. Powers,

I wished you to a draught of milk every morning from the cow, with 1 spoonful of true muscadine, or so much mallago sack instead thereof, but, in case 2 spoonful do not curdle it, I pray take 2 still, but, in case your stomach bears it, take the quantity of a wine pint at a time, ascending to a common pint

at length, or somewhat more. The Londoner spake like a pothecary, of himself to determine such an event. I have seen it oft cured in as old as you, especially in 2 but last year; the one was old goodman Church of our town, the other Mr. Chessam of Dampton, who was all over like a dried leather skin, his legs as black as the stock and as sore and lame as a cripple. It was within the compass of my skill and God his blessing to help these. But this season is not propitious to eradicative physick, therefore I pray go on with nourishing things as milk, in the morning and evening, in manner aforesaid. At noon take good heavy jelly broth made of capon, veal, sparrows, sliced dates, raisins solis, hartshorn and a crust of bread, or the broth of a foreleg of beef, broke down, boiled, and the marrow taken out before, and the fat taken off, then boiled with a chicken, dates, raisins, sparrows, and flowers of clary. (22). These will nourish much. Take between meals of currants steeped in muscadine, a spoonful at a time. To quench your thirst in the night take of this following, take of the juice of a pomegranate and the juice of oranges equal parts, put to them as much syrup of lemons as both. Take of this in the night at your pleasure. I would feign see that water of yours that is like muscadine. I had your letter just when the messenger was upon his return. In haste, with my most humble service to Sir Oliver, my true love to yourself, I rest

Your faithful friend
Jo. Symcotts.

Dec. 4 1641.

Ad. MSS. 33464. f. 33.

Mr. Powers,

I have sent you by Dr. Symcotts' direction a plaster for your back and some hartshorn, and dates, and clary. The plaster is to be applied about the kidneys, warm; lay it on longways so that the bare place in the middle of it may lie upon the backbone, and bind it on for a fortnight, or more, renewing it if need be, and you find benefit by it. He intends it for the strengthening of

(22) Clary, a labiate plant, *Salvia Sclarea*, a native of Europe, Syria etc., cultivated in English gardens as a pot herb. Hence clary-water, clary-wine, a sweet cordial, or medicinal drink.

your back. We have no clary flowers, but we have sent some of the herb which the doctor conceives as good for you. So with my kind respects, I rest,

Your true friend,
G. FULLWOOD.

12 *Dec.* 1641.

Ad. MSS. 33464. f. 34.

Good Mr. Powers,

A letter which you sent on Saturday was not given me (though at home) till Monday at noon. I am sorry to hear of your state, yet that unmeasurable urine which you mentioned before was the only thing I feared and, in that respect, wish the plaster to be laid to your reins to cool the kidneys, whose heat draw all the liquid juices to them. In your letter dated the 3rd of December you tell me you are very hot many times in the night, but, in that dated the 10th of December, you recant, I perceive the truth of the former by this too plentiful urine which you mention. I pray use this means following. Take oftimes in the day of milk, whereto (add) so much water wherein the sixth part of the red rose leaves is boiled from 3 pints to 2, and let both the milk and water apart have hot gads of steel quenched in them, then what quantity you take let it be sweetened a little with the syrups in the glass, or sugar sometimes, for change. Also I would have you take of the electuary in the pot as much as a hazel nut, 3 times in the day, and so much at night, last of all. If you eat a dinner let it be of calves' or sheeps' feet, the gristles of beef, or such meat as have tenacious moisture, otherwise your lurking heat will melt them into urine. I except not against those nourishing broths which I directed before, but desire you to quench steel in them also as in the milk, in which be most frequent. After broth or meat take small beer with juice of Seville orange, but avoid all things that move urine, as wine alone, strong stale, sharp, or much beer, or the like. The Lord bless all unto you. So prays your assured friend

JOHN SYMCOTTS.

29 *Dec.* 1641.

Ad. MSS. 33464. f. 37.

Good Mr. Powers,

In case you cannot get new milk, take the other and mix it with one half plain barley water to 2 parts of milk, put muscadine to it as before; you cannot leave off milk without much prejudice for that it cools and moistens much. For heat in the night, you may take a little barley water, with juice of sweet orange or pomegranate, if it may be got. I like your sweating, for it diverts the matter. I am in post haste, yet rest ever your faithful friend,

JOHN SYMCOTTS.

19 *Febr.* 1642.

Ad. MSS. 33464. f. 46.

Sir,

The doctor is not at home but we expect him tomorrow at night, and as soon as he comes he shall have your letter. For the pills, they have done their office, for they were but for one night's remedy. You need not wonder that your cure is no further on foot, you may rather wonder that you was not in your grave long before this, and for the perfect cure of that which you say is in your chest, I can not promise you that it will ever be done. Yours to command

EDW. JOHNSON.

Ad. MSS. 33464. f. 47.

Sir,

The doctor is not at home; as soon as he comes your letter shall be given him. In the mean while, my master hath sent you some conserve of berberries for your mouth, of which you may please to take now and then the quantity of nutmeg. Lick also of the lohock in the pot, often at your pleasure, with the licorice stick, 2 or 3 licks at a time. You may also take sometimes some stewed prunes, holding the stones in your mouth a little while. For the use of your milk, it is best to take it always hot from the cow if you can get it, but for that you shall hear from the doctor. Thus in haste, being very glad to hear of your recovery, I rest, Yours to command

EDW. JOHNSON.

(The following directions, notes, and bill cannot be related to any of the foregoing letters.)

Ad. MSS. 33464. f. 15.

First the doctor desires you will please to take all the potion in the biggest glass on a morning fasting, cold or warm as you please, and 2 or 3 hours after take some warm broth, and so broth now and then, as it works; shake it well when you take it and take all the bottom, as soon as you have taken it wash your mouth with vinegar and smell to vinegar a good while after. Keep warm and forebear sleep and cold drinks till it hath done working.

And that night to bedward swallow upon a knife's point half the cordial bole in the biggest box and so compose to rest.

The next day but one (or if you please you may intermit 2 days) then swal ow any way you can best all the 3 pills in the least box, in the morning fasting, and 2 or 3 hours after take some warm broth sometimes, as they work, and keep warm.

And that night to bedward take the rest of the cordial bole and so rest.

Take a spoonful of the syrup in the least glass once in 3 hours, licking it with a licorice stick. Take of the lohock in the pot with a licorice stick also or upon a knife's point at other times, when you do not take the syrup; take this as often as you please, and continue them both as long as they last, but do not begin the syrup and the lohock until you have done the pills.

(In Powers' hand)

This physick I took after my great sickness.

This bill came to me the 15th of September 1638. The 17 I took the potion and the 19th I took the 3 pills which night I was almost smothered with too much fire in my chamber, had not James Stopforth come in and found me in a great heat and senseless. This was my great sickness.

Ad. MSS. 33464. f. 16.

First you may please to take 4 of the purging pills in the middle box in the morning fasting. Swallow them anyway you can best, and 2 or 3 hours after take some warm broth and keep warm.

And that night to bedward swallow 2 of the cordial pills in the least box and so compose to rest.

The next day in the morning take the other 4 purging pills, and that night to bedward the other 2 cordial pills, after the same manner, and with like order as before.

Spread the mithridate in the biggest box upon the leather bound with it, and apply it to the pit of your stomach, lay the little end of the plaster upwards, bind it on and wear it a week or more.

Always after dinner, when you are most hot, in every draught of beer you drink put 2 spoonfuls of the julep in the glass, as long as it lasts.

Drink a draught of wormwood wine every day half an hour before dinner and supper, and at your meals also, if you please, and if you have not wormwood wine steep wormwood in wine to take instead of it.

After you have taken the pills, whensoever you find the risings at the mouth of your stomach, take a little of the green ginger in the pot, as long as you please.

(In Powers' hand)

Mr. Fullwood's note touching the last physic he sent me which I took not.

Ad. MSS. 33464. f. 17.

(In Powers's hand)

Mr. Fullwood's bill in my great sickness

May 20 1637 For Mr. Powers of Ramsey

1638		(£ s. d.)
Aug. 25	An ointment	0. 0. 10.
	Juice of berberries ii glass	0. 0. 5.
	Mirabilons etc. to boil	0. 0. 6.
	Electuary Leintive	0. 1. 2.
	Plantain water 1 quart glass	0. 1. 10.
Sept. 12	A gargarism with sal prunela etc.	0. 1. 0.
15	A purging potion	0. 2. 0.
	Purging pills	0. 0. 9.
	A coridal bole for twice	0. 0. 10.
	Pectoral syrups ii glass	0. 0. 7.
	A pectoral lohock	0. 2. 0.
27	Stomacacal pills for twice	0. 0. 10.
	A Julep	0. 1. 3.

4 cordial pills	0. 1. 0.
Mithridate for a plaster	0. 0. 6.
China ginger and pot	0. 0. 8.
	0.16. 2.

(In Powers' hand)

Paid Garrett 2 s. 6 d.

Sent by Mr. Peacock the 16th day of January 1639. The full of this bill 9 s. 8 d.; 2 s. 6 d. for Mr. Symcotts.

Ad. MSS. 33464. f. 18.

For Mr. Powers 2 May 1639.

First take all the potion in the biggest glass on a morning fasting, cold and well shaken together, and 2 or 3 hours after a little thin warm broth some times, as it works, keeping warm within the house all the day and night after. And that night to bedward swallow down (without chewing) half the cordial in the bigger box and so rest.

The next morning fasting take half the syrups in the least glass in a draught of warm posset ale wherein a few camomile flowers have been boiled, and the other half that afternoon about 4 o'clock, in like manner.

The next morning about 6 o'clock swallow down (in anything you please) all the 4 pills in the less box and observe the same order that day as when you took the potion. And that night to bedward take the rest of the cordial.

Afterward draw up some of the water in the middle glass into your nostrils warm every morning fasting and about an hour before supper, so long as it lasts.

(In Powers' hand)

The potion gave me	9 stools
The syrup	4 stools
The 4 pills	11 stools

Ad. MSS. 33464. f. 28.

Hang this bag into 2 wine gallons and a half of good ordinary stew ale or beer, when you tun it up, and tun it up young. Put loaf (sugar) into the ale, at the same time also a pound of raisins sun, stoned, and so let them work together. When it hath done

working, cover up the vessel very close and after 5 or 6 days standing, drink so much every morning fasting (about six o'clock) as will work 3 or 4 or 5 times a day with you. You may begin with 3 quarters of a pint the first day and so take more or less every day after, as you find it works, and 2 hours always after take a mess of thin warm broth with as much of the powder in the little white paper as will lie upon 3 d. And so keep warm, especially warm clothed, all the time you take of it.

And every night (when you take this drink) when you go to bed take about the quantity of a nutmeg of the electuary in the flat pot and so compose to rest.

In the meanwhile, till your diet drink be ready, take every morning fasting about 6 o'clock the quantity of a walnut of the lohock in the big pot and fast always 2 hours after, without any further strict observation. And about 4 o'clock in the afternoon take so much more after the same manner and with like order. When you have finished this course, you must send for mithridate to take morning and evening, therefore, I pray remember to send for it.

(In Powers' hand)

The doctor bade me make the ale good strong, it would work the better. This drink Besse Wells brewed for me the first of October 1641. All which summer I was sick from midsummer to All Saints Day.

(Cornell University, Ithaca, New York).

FREDERICK GEORGE MARCHAM.

Boyle's conception of Element compared with that of Lavoisier (*)

It has been thought remarkable that our present conception of chemical element was set forth clearly by ROBERT BOYLE in « The Sceptical Chymist » (1661) but that it played no important part in the progress of chemistry until more than a century later when LAVOISIER put the conception to work in the laboratory. Why did it take so long? There can be no doubt about the wide diffusion of BOYLE's ideas, for the number of the editions of his book is testimony of it. It is interesting that the phlogiston doctrine arose during the period between BOYLE and LAVOISIER. Yet the phlogiston doctrine had for a long time but little effect upon the thinking of chemists. BOERHAAVE ignored it, and phlogiston became of importance only when it became an object of attack. The situation is still more interesting when we consider that « The Sceptical Chymist » was not written for the purpose of setting forth a conception of element—and that the conception which it does set forth was not original with BOYLE.

In « The Sceptical Chemist » BOYLE takes the prevailing notion of chemical element and sets out to inquire whether the so-called « elements » and « principles » of the alchemists and chemists of his time are in conformity with that notion. He concludes that they are not, or, at least, that the evidence already adduced in favour of their conformity is inadequate. The real purpose of the book appears to be a search after criteria by which it may be determined whether a given substance is or is not an element in the sense of the prevailing conception, and its great importance for the history of chemistry lies in the fact that it agitates that question and insists upon the necessity of experimental evidence

(*) Paper read before the History of Chemistry Division at the eightieth meeting of the American Chemical Society, Cincinnati, Ohio, September 8-11, 1930.

for its solution. BOYLE was unable to find the desired criteria, but he did reach the conclusion that chemical changes are best explained by supposing that matter consists of corpuscles or atoms.

Near the beginning of the « Praeface Introductory », BOYLE points out that it is necessary to take the ultimate constitution of matter into consideration for the explanation of chemical phenomena. « For I observe », he says, (1) « that of late Chymistry begins, as indeed it deserves, to be cultivated by Learned Men who before despis'd it; and to be pretended to by many who never cultivated it, that they may be thought not to ignore it: Whence it is come to passe, that divers Chymical Notions about Matters Philosophical are taken for granted and employ'd, and so adopted by very eminent Writers both Naturalists and Physitians. Now this I fear may prove somewhat prejudicial to the Advancement of solid Philosophy : ... And for ought I can hitherto discern, there are a thousand Phaenomena in Nature, besides a Multitude of Accidents relating to the humane Body, which will scarcely be clearly & satisfactorily made out by them that confine themselves to deduce things from Salt, Sulphur and Mercury, and the other Notions peculiar to the Chymists, without taking much more notice than they are wont to do, of the Motions and Figures, of the small Parts of Matter, and the other more Catholick and fruitful affections of Bodies. »

The book is an account of a friendly debate between gentlemen who have foregathered in a garden arbor on one of the fairest days of summer. They discuss the « number of the Elements, Principles, or Materiall Ingredients of Bodies. » The book is written (2) « in a stile more Fashionable then That of meer scholars is wont to be » with language « more smooth, and the Expressions more civil than is usual in the more Scholastick way of writing », and gives « an example how to manage even Disputes with Civility; whence perhaps some Readers will be assisted to discern a Difference betwixt Bluntness of speech and Strength of reason, and find that a man may be a Champion for Truth, without being an Enemy to Civility; and may confute an Opinion without railing at Them that hold it. »

(1) ROBERT BOYLE, *The Sceptical Chymist*, 1st. ed., London, 1661, second leaf after title page.

(2) Sixth leaf.

Carneades (representing BOYLE) opens the discussion by pointing out the unsatisfactory status of the question. (3) « Notwithstanding the subtile reasonings I have met with in the books of the Peripateticks, and the pretty experiments that have been shew'd me in the Laboratories of Chymists, I am of so diffident, or dull a Nature, as to think that if neither of them can bring more cogent arguments to evince the truth of their assertion then are wont to be brought; a Man may rationally enough retain some doubts concerning the very number of those materiall Ingredients of mixt bodies, which some would have us call Elements, and others principles. Indeed when I considered that the Tenents concerning the Elements are as considerable amongst the Doctrines of natural Philosophy as the Elements themselves are among the bodies of the Universe, I expected to find those Opinions solidly establish'd, upon which so many others are superstructed. But when I took the pains impartially to examine the bodies themselves that are said to result from the blended Elements, and to torture them into a confession of their constituent Principles, I was quickly induc'd to think that the number of the Elements has been contended about by Philosophers with more earnestness then success. This unsatisfiedness of mine has been much wonder'd at, by these two Gentlemen (at which words he pointed at *Themistius* and *Philoponus*) who though they differ almost as much betwixt themselves about the question we are to consider, as I do from either of them, yet they both agree very well in this, that there is a determinate number of such ingredients as I was just now speaking of, and that what that number is, I say not may be (for what may not such as they perswade?) but is wont to be clearly enough demonstrated both by Reason and Experience. This has occasion'd our present Conference. »

Eleutherius, another of the interlocutors, is glad to find that the several gentlemen are resolved to insist rather on experiments than on syllogisms. He says (4) « For I, and no doubt You, have long observed, that those Dialectical subtleties, that the Schoolmen too often employ about Physiological Mysteries, are wont much more to declare the wit of him that uses them, then

(3) Pp. 9, 10, 11.
(4) Page 14.

increase the knowledge or remove the doubts of sober lovers of truth. » He hopes that they will no longer delay the discussion but will at once (5) « lay down what should be all along understood by the word Principle or Element. *Carneades* thank'd him for his admonition, but told him that they had not been unmindful of so requisite a thing. But that being Gentlemen and very far from the litigious humour of loving to wrangle about words or terms or notions as empty; they had before his coming in, readily agreed promiscuously to use when they pleased, Elements and Principles as terms equivalent : and to understand both by the one and the other, those primitive and simple Bodies of which the mixt ones are said to be composed, and into which they are ultimately resolved. »

The progress of the argument does not concern our present purpose. We pass over a large portion of the book. In the Sixth Part or « Paradoxical Appendix », after *Carneades* has said all that he thinks needful in opposition to the chemical doctrine of the three principles, *Eleutherius* addresses him (6) « I halfe expected, *Carneades*, that after you had so freely declar'd Your doubting, whether there be any Determinate Number of Elements, You would have proceeded to question whether there be any Elements at all. » *Carneades* replies, saying in part (7) « To prevent mistakes, I must advertize You, that I now mean by Elements, as those Chymists that speak plainest do by their Principles, certain Primitive and Simple, or perfectly unmingled bodies; which not being made up of any other bodies, or of one another, are the Ingredients of which all those call'd perfectly mixt Bodies are immediately compounded, and into which they are ultimately resolved : now whether there be any one such body to be constantly met with in all, and each, of those that are said to be Elemented bodies, is the thing I now question. » *Carneades* continues by saying that he believes the principles of the world to be matter, motion, and rest, and adds some very interesting speculations relative to the ultimate (corpuscular) constitution of matter. The fact that the conception of element which was

(5) Page 16.
(6) Page 348.
(7) Page 350.

acceptable to the gentlemen at the beginning of the discussion is the same as that which is acceptable at the end of it shows clearly that « The Sceptical Chymist » was not written for the purpose of setting forth a conception of element—and suggests that the conception of which it does make use is the one which was prevalent at the time of BOYLE.

« The Sceptical Chymist » is distinctly inconclusive. The gentlemen seem to know what they mean by the term, element, but are unable to find experiments for determining the fitness of its application. The next to the last paragraph in the book ends as follows. (8) « I perceive I need not minde you that the Objections I made against the Quaternary of Elements and Ternary of Principles needed not to be oppos'd so much against the Doctrines Themselves (either of which, especially the latter, may be much more probably maintain'd than hitherto it seems to have been, by those writers for it I have met with) as against the unaccurateness and the unconcludingness of the Analytical Experiments vulgarly Relyed On to Demonstrate them. » The book terminates with a statement of the sceptical position of the author. « And (concludes *Carneades* smiling) it were no great disparagement for a Sceptick to confesse to you, that as unsatisfy'd as the past discourse may have made you think me with the Doctrines of the Peripateticks, and the Chymists, about the Elements and Principles, I can yet so little discover what to acquiesce in, that perchance the Enquiries of others have scarce been more unsatisfactory to me, than my own have been to my self. »

That BOYLE's conception of element was not original with him is demonstrated by its use in earlier writers. We quote first two Englishmen who wrote a few decades earlier than the appearance of « The Sceptical Chymist ». Sir KENELM DIGBY in his « Treatise on the Nature of Bodies » argues that air, earth, fire, and water differ from one another in their endowments of quantity, rarity, and density, and concludes (9) that « these four bodies are ***Elements:*** since they cannot be resolved into

(8) Pp. 435, 436.

(9) Sir KENELM DIGBY—*Two Treatises: In the one of which, The Nature of Bodies; In the other, The Nature of Mans Soul, Is Looked Into: In Way Of Discovery Of The Immortality of Reasonable Souls*, London, 1658, page 38. The author's introductory letter to his son is dated 1644.

any others, by way of Physical composition; themselves being constituted by the most simple differences of a body. And again, all other bodies whatsoever must of necessity be resolved into them, for the same reason; because no bodies can be exempt from the first differences of a body. Since then, we mean by the name of an *Element, a body not composed of any former bodies, and of which all other bodies are composed*, we may rest satisfied that these are rightly so named. » The practical JOHN BATE at the beginning of his directions for the manufacture of fireworks lays down « Certaine Praecognita or Principles », the first of which states (10) that « The foure Elements, Fire, Ayre, Earth, and Water, are the *prima principia* (I meane the materialls) whereof every sublunary body is composed, and into the which it is at last dissolved. » These conceptions of element are the same as BOYLE's conception, they are the same as our own today—they are the same as that of THALES (about 624-545 B.C.) which is perhaps the earliest with which we are acquainted. Although none of the writings of THALES have come down to us, ARISTOTLE describes his views. (11) « Most of the early philosophers were content to seek a material first principle as the cause of all things. For that of which all things consist, from which they arise, into which they pass away, the substance remaining the same through all its changing states—that, I say, is what they mean by the element or the first principle, of the things that are. And this is why they hold that, strictly speaking, nothing comes into being or perishes, since the primal nature remains ever the same. There must be some natural body, one or many, from which all things arise, but which itself remains the same. But of what sort this first principle is, and how many such there are, this is a point upon which they are not agreed. THALES, the originator of this kind of philosophy, declares it to be water. » ARISTOTLE himself thought that the material body or bodies, « one or many, from which all things arise », were four in number, and his view was

(10) JOHN BATE—*The Mysteries of Nature and Art. In foure severall parts. The first of Water works. The second of Fire works. The third of Drawing, Washing, Limming, Painting, and Engraving. The fourth of sundry Experiments. The second Edition; with many additions unto every part*, London, 1635, page 93.

(11) ARISTOTLE, *Met.*, I., 4., from CHARLES M. BAKEWELL—*Source Book in Ancient Philosophy*, New York, 1907, page 1.

very generally prevalent until the time of LAVOISIER. We hold a different opinion about the number of the elements. But the elements, about the number of which we hold the opinion, are still conceived as THALES conceived his one, as Aristotle conceived his four, and as the sceptical BOYLE conceived the body or bodies which he wished to identify but knew not how.

It appears that LAVOISIER had a conception of element which was approximately twenty three centuries old. What did he do with it? How, if at all, did he modify it? The answer that LAVOISIER treated the conception pragmatically and sought by experiment to demonstrate the implied consequences of his meaning is somewhat too naïve. In his Introduction to a modern edition of « The Sceptical Chymist », M.M. PATTISON MUIR says (12) « Until delicate instruments for determining changes of weight had been perfected, the way was not made clear for the use of a purely pragmatic conception of element. When—LAVOISIER gave to chemists the description of an element as a substance which has not been separated into simpler substances, and added to this the practical test of simplification, chemistry advanced by leaps and bounds. LAVOISIER's pragmatic descriptions of element and simplication were these—a material substance is to be classed as compound and not-elementary (13) when from a determinate weight of it are obtained other substances, the weight of each of which is less than the weight of the original, and the sum of the weights of which is equal to the weight of the original; and the original weight of the first substance is formed by bringing together, under proper conditions, the separate weights of the other substances. » It is undoubtedly true that chemistry « advanced by leaps and bounds » after LAVOISIER and because of LAVOISIER, but the just-quoted statement is inexact in a number of respects. LAVOISIER was not the first to treat an element as the last term of analysis. Although he used the balance with such effect as to produce a new epoch in chemistry, he does not seem to have insisted, as PATTISON MUIR suggests, that the balance is the only instrument whereby the last term

(12) Everyman's Edition, London and New York, page XIX.

(13) My copy of Everyman's edition reads « is to be classed as elementary », but this is plainly a misprint and contrary to the intent of the Editor.

of analysis may be recognized with certainty. He certainly did not make any such pragmatic description of simplification as that which is here ascribed to him, for he was willing to accept a philosophical or metaphysical analysis and regarded heat *(calorique)* as an element, (14) as « a real and material substance, a very subtle fluid which insinuates itself between the molecules of all bodies and separates them. »

Let us see what LAVOISIER says of element. (15) « All that can be said on the number and on the nature of the elements is, I think, limited to the purely metaphysical. The problems which are here proposed for solution are indeterminate and susceptible of an infinitude of solutions, of solutions of which it is probable that none is in accord with nature. I shall content myself then with saying that if by the name of element we mean to designate the simple and indivisible molecules which compose bodies, it is probable that we are not acquainted with them. If on the contrary we attach to the name of element or principle of bodies the idea of the last term to which analysis reaches, then all substances which we have not yet been able by any means to decompose are elements to us—not that we can be sure that these bodies which we regard as simple may not themselves be composed of two or even of a greater number of principles, but since these principles are never separated, or rather, since we have no means of separating them, they act as far as we are concerned in the manner of simple bodies, and we ought not to suppose them compounded until experience and observation shall have furnished the proof. »

MACQUER in his « Dictionnaire de Chymie » had earlier defined element (16) in the same pragmatic manner, and had pointed out that the four Aristotelian elements are in conformity with the definition. It seems probable that others before MACQUER had understood the scope of the definition in the same way.

« The name of element is given in chemistry to bodies which are of such simplicity that all the efforts of art are insufficient to decompose them or even to cause any sort of alteration in them,

(14) LAVOISIER, *Traité Élémentaire de Chimie*, 1st ed., Paris, 1789, page 4.

(15) Pages XVII, XVIII.

(16) MACQUER, *Dictionnaire de Chymie*, 2nd. ed., Paris, 1778, volume 2, page 3, article *élémens*.

and which, on the other hand, enter as principles or constituent parts into the combination of other bodies, which for that reason are called compounded bodies.

« The bodies in which this simplicity has been recognized are *fire*, *air*, *water*, and the purest *earth*, because the most complete and the most exact analyses that it has been possible to make up to the present have in fact never produced in the last resort anything else but one or the other or others of these four substances, or all of the four according to the nature of the bodies that have been decomposed.

« It is very possible that these substances may not be simple as they are reputed, that they may even be very much compounded, that they may result from the union of many other more simple substances, or that they may be transmutable into one another as M. *le Comte de* BUFFON thinks. But, since experience teaches us absolutely nothing on this point, we may without inconvenience—we ought even—in chemistry to regard *fire*, *air*, *water*, and *earth* as simple bodies because they act as such as a matter of fact in all the operations of this art. »

We are obliged to admit that LAVOISIER did little or nothing consciously to modify the prevalent *abstract* conception of element. He did however finally destroy the Aristotelian elements by showing that fire is a phenomenon and not a thing which possesses weight. BOYLE had tried to weigh fire. Other chemists who considered it an element thought it too subtle and intangible to be weighed on the most sensitive balance. LAVOISIER of course did not prove that fire can not be weighed. He showed that it is a concomitant of the weight changes of oxidation. Oxygen and the oxidized substances are things because they can be weighed. Fire is the phenomenon displayed at the moment of the oxidation. Heat, however, LAVOISIER still regarded as an element although it can not be weighed.

LAVOISIER's success in using the balance in the interpretation of combustion led him to use it in the study of other reactions. Other chemists began to use it. The law of combining weights was discovered, and quantitative chemistry commenced. Let us recall again that LAVOISIER did not consider the balance to be the only means of identifying an element as the last term of analysis. It was the successful use of the balance in the study of combustion

which led to its use for other studies. And it is likely that this use was also determined by an increasing appreciation among chemists of the significance of number, for the philosophy of JOHN LOCKE (1632-1704) had fertilized the intellectual soil of eighteenth century Europe for the growth of quantitative science. Indeed, we may doubt whether the weight-test for deciding the elementary nature of a substance was fully and consciously accepted by chemists until after the time of DALTON, until the time when combining weights were understood.

During the period preceding CANNIZZARO an element was a substance whose combining weight was one particular number or some small multiple of that number. Not long thereafter an element became a substance which had one atomic weight and only one, but that state of affairs did not long prevail. Isotopes were discovered, and an element now is a substance which has an atomic number. The weight-test has disappeared. We resort to X-ray spectra. To the question, What sort of things are the elements? the answer was once given—hard impenetrable atoms which differ in shape, then atoms which differ in weight, compressible atoms, arrangements of electrons and protons, and now apparently arrangements of waves. Yet our abstract notion of element—the natural body or bodies, one or many, of which all things consist, from which they arise, into which they pass away—is the same today as it was in the time of LAVOISIER or BOYLE, ARISTOTLE or THALES.

Massachusetts Institute of Technology,
Cambridge, Massachusetts. TENNEY L. DAVIS.

Die Sternbilder der alten Aegypter

Unsere Kenntnisse von den ägyptischen Sternbildern beruhen auf Angaben in der Literatur, auf Darstellungen von Dekan- und anderen Sternbilderlisten in Gräbern und Tempeln und auf Darstellungen des gesamten ägyptischen Sternbilderhimmels in Tempeln. Allerdings sind uns keine Sternkataloge überliefert und die überlieferten Nachrichten sind so wenig einheitlich, beziehen sich zum Teil auf verschiedene Zeitalter, sodass bisher nur die wenigsten ägyptischen Sternbilder identifiziert werden konnten. Angesichts dieses Umstandes mag ein Überblick über unser Wissen nicht unwillkommen erscheinen.

Die überlieferten Mitteilungen über ägyptische Sternbilder, besonders aus griechischen Quellen, hat F. BOLL, in seinem Buche « Sphaera (Leipzig 1903) » zusammengestellt. Aus den astrologischen Schriften der TEUKROS, ANTIOCHOS und VALENS führt er folgende Sternbilder auf : Typhon (Ursa major); Osiris (Orion); Schiff (Argo); Anubis (Lepus); Sopdet = Sothis (Sirius); der Dekan mit den Lampen; der Hundskopfaffe, der zweimal als Sternbild auftritt; der kopflose Mann; das Messer; der Wagenlenker und der Knabe mit dem Becher; der Leichnam ; der stierköpfige Pflüger (Bootes). Dabei sind die entsprechenden modernen Bezeichnungen der Sternbilder in Klammern dahinter angegeben. Allerdings wird die ägyptische und die moderne Begrenzung der Sternbilder nicht übereinstimmen.

Zu diesen Sternbildern kommen noch hinzu die im 3. Jahrtausend v. Chr. erwähnten Sternbilder wie die Äffinnen, welche die Köpfe abschneiden; der Strauss am See; der Prachtkopf; der Scheitelfasser; der Läufer mit Messern; ferner im 2. Jahrtausend das Sternbild des Kalbes. Alle diese Sternbilder sind nicht zu identifizieren.

Wichtiger für die Erkenntnis der ägyptischen Sternbilder sind die Darstellungen einzelner Gruppen von Sternbildern, wie sie

uns vom Ende des 3. Jahrtausends an bis zur römischen Zeit vereinzelt in den Gräbern oder Tempeln begegnen. Die ältesten Darstellungen sind die im Grabe des MSAHITI und im Gräberfelde von Siut aus der 2. Hälfte des 9. bis zum Ende des 10. Herrscherhauses, also etwa aus dem 22. und 21. Jahrhundert (1); dann folgen der Zeit nach die Darstellungen im Grabe des SENMUT, der unter der Königin HATSCHEPSUT um 1500 lebte (2), auf der Wasseruhr (3) aus der Zeit des AMENOPHIS III., der von 1411-1375 herrschte, im Grabe des SETHOS I., der von 1313-1292 herrschte, im Ramesseum zu Theben, erbaut von RAMSES II., der von 1292-1225 herrschte, in zwei thebanischen Königsgräbern des 20. Herrscherhauses, also vom 12. Jahrhundert; im Grabe der ḤETAR, aus der römischen Zeit; im Tempel zu Philae und im Tempel zu Edfu, die beide aus der Ptolemäer-Zeit stammen (4); in dem bald nach Christi Geburt nach altem Vorbild wieder errichteten Tempel zu Dendera und im Nordtempel zu Esne aus der römischen Zeit (5).

Auf diesen Darstellungen sind besonders beachtenswert die Nordpolgegend und die Dekanreihe. Die Polgegend soll vermutlich alle die Sternbilder darstellen, welche für Ägypten nie untergingen, also zirkumpolar waren. Sieht man sich die verschiedenen Bilder auf die Darstellung des Stieres oder Stierschenkels an, so lassen sich zwei Gruppen unterscheiden, die wir Khiti-Gruppe und Sethos-Gruppe nennen wollen, da sie in den betreffenden Gräbern zuerst auftreten.

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(1) LACAU, Catalogue général des antiquités égyptiennes du musée du Caire, Sarcophages, Le Caire 1906.

E. CHASSINAT et CH. PALANQUE, Une campagne de fouilles dans la nécropole d'Assiout (Mémoires publiés par les membres de l'institut français d'archéologie orientale. Le Caire 1911).

(2) A. POGO, The astronomical ceiling-decoration in the tomb of Senmut (*Isis*, XIV, S. 301).

RÖDER, Eine neue Darstellung des gestirnten Himmels in Ägypten aus der Zeit um 1500 v. Chr. (*Das Weltall* 28, S. 1).

(3) LUDWIG BORCHARDT, Altägyptische Zeitmessung (E. v. BASSERMANN-JORDAN, die Geschichte der Zeitmessung und der Uhren, Band I, Lieferung B, Berlin 1920).

(4) H. BRUGSCH, Thesaurus inscriptionum aegyptiacarum, 1. Abt. Astronomische und astrologische Inschriften der altägyptischen Denkmäler, Leipzig 1883-84).

(5) LETRONNE, Analyse critique des représentations zodiacales de Dendéra et d'Esné (*Mémoires de l'Académie R. des inscriptions et belles-lettres*, Tome 16, Paris 1846).

Zur Khiti-Gruppe gehören die Darstellungen im Grabe des KHITI (I), im Grabe des SENMUT (II), auf der Wasseruhr (III), im Ramesseum (IV), in einem thebanischen Königsgrabe (V = BRUGSCH Abb. 125 A), im Grabe der ḤETAR (VI), im Tempel zu Philae (VII), zu Edfu (VIII), zu Dendera (IX) und Esne (X); sie weist folgende Sternbilder auf :

1) Der Stierkopf mit spitz zulaufendem Hinterleib. (Mascheti, Vorderschenkel des SET). Das Grab des SENMUT und die Wasseruhr weisen 4 bez. 2 kleine Füsse auf. Die Darstellung im Grabe des KHITI zeigt auf dem Schenkel, der aber ohne Stierkopf dargestellt ist, die 7 Sterne des Grossen Bären. Im Grabe des SENMUT (*Isis* XIV, Pl. 16) ist der Stierkörper mit einem zweimal geknoteten Strick an den Knopf eines hohen spitzen Mastes angebunden. Das Ganze ähnelt der Befestigung der Luftschiffe an dem Haltemast, nur dass der Stierkörper eher einem Kinderdrachen als einem Zeppelin gleicht. Dieselbe Befestigung zeigt auch die Wasseruhr; dagegen ist die Stange im Ramasseum nur noch angedeutet und fehlt auf den anderen Bildern.

2) Hinter dem Stierschenkel steht eine Frau « Selket (Skorpion) » in II-V.

3) Ein sperberköpfiger Mann « der Kämpfer und Wender » berührt mit einer Lanze den Unterteil des Stiers, in II-VI, IX und X.

4) Darunter liegt ein Löwe mit dem Kopf zum Mast hin gewendet, in II-VI. Die Wasseruhr zeigt ihn mit einer Kette am Mast befestigt.

5) Unter dem Löwen liegt ein Krokodil, in II-VI.

6) Dieses Krokodil ist zu einem Manne hingewendet, der es in II mit der rechten Hand und in V mit einer Lanze berührt.

7) Auf der anderen Seite des Mastes steht ein Nilpferd « Isis als Nilpferd » (in II-X), das sich mit der rechten Hand auf ein Messer oder Pflock (in II-V und X) und mit der linken Hand auf ein kleines Krokodil (?) (in II-V und X) stützt. In III und IV geht eine Kette vom Knopf des Mastes zu dem in der Erde steckenden Ende des Pflockes; V zeigt diese Kette nicht, während in II die rechte Begrenzungslinie des Mastes neben der Pflockspitze den Boden berührt und dadurch wohl die Verbundenheit von Mast und Pflock anzeigen soll. In VII-X hält das Nilpferd mit einer Kette den Stierschenkel fest. In VI hält das Nilpferd in

der rechten Hand das Messer zum Schenkel hin, während die Kette von der Hand in entgegengesetzter Richtung hinunterhängt. Offenbar handelt es sich hier um ein Versehen des Malers.

8) Hinter dem Nilpferde steht ein Krokodil, das aber auf der Wasseruhr wegen der Zerstörung der betreffenden Stelle nicht zu sehen ist, in II, IV, V und X.

In diesen Darstellungen zeigt sich eine Entwicklung. Ob die Khiti-Darstellung für die älteste Zeit typisch ist oder nur einen Ausschnitt aus der Polgegend, wegen der Enge des Raumes, darstellen soll, lässt sich zur Zeit nicht entscheiden. Wichtiger sind deshalb die Darstellungen II-V des 15-13. Jahrhunderts und VI-X des 3. Jahrhunderts bis Christi Geburt, in denen die Nilpferdgöttin, der Stierschenkel und seine Ankettung eine grosse Rolle spielen und zwar scheint die Ankettung an den Mast der Ankettung an die Nilpferdgöttin vorauszugehen.

Die Sethos-Gruppe, bestehend aus den Darstellungen im Grabe des SETHOS I. und in zwei thebanischen Königsgräbern (BRUGSCH Abb. 125 B und 126), stimmt mit der Khiti-Gruppe hinsichtlich der Sternbilder 2-6 und 8 überein; dagegen weist sie grosse Unterschiede hinsichtlich des Stierschenkels und der Nilpferdgöttin und ihrer Beigaben auf. Das Nilpferd ist immer stehend wiedergegeben; jedoch fehlt das Krokodil und an die Stelle des Messers ist eine Vase gereten. Der Stier ist vollständig wiedergegeben und nicht an einen Mast angebunden; nur im Sethos Grab führt ein doppelter Strick von ihm bis zur Vase vor dem Nilpferde. Ferner ist unter dem Stier eine gerade, in der Mitte nach oben oder unten gekrümmte Linie zu sehen.

Was stellen diese Sternbilder vor? Wie uns PLUTARCH berichtet, soll der Stier den Grossen Bären darstellen, wobei man hauptsächlich an die 7 hellsten Sterne dachte. Ferner heisst es in einer Inschrift in den thebanischen Königsgräbern, dass die 4 Götter als Diener den Gräulichen, nämlich den Set oder Stierschenkel, vom Kampf abhalten und an ein Seil legen. Isis in Nilpferdgestalt hat auf das Ungeheuer aufzupassen. Damit erklärt sich auch die Verbindung zwischen Stier und Isis durch die Stricke oder Ketten. Offenbar soll durch dieses an den Pflock-Legen des Stierschenkels das tägliche, auffällige Umkreisen dieses Sternbildes um den Himmelspol versinnbildlicht werden; man wird dabei unwillkürlich an die alte griechische Vorstellung von

dem Angebundensein der Sterne an eine sich drehende Spindel — die Weltachse — erinnert. Noch deutlicher kommt diese Vorstellung in der Ankettung des Stierschenkels und auch des Löwen an den Mast zum Ausdruck. Merkwürdigerweise wird diese alte Vorstellung der Ankettung an die Weltachse im Laufe der Jahrhunderte zuerst zu Gunsten der Ankettung an den Pflock und später zu Gunsten der Ankettung an das Nilpferd selbst aufgegeben, gleichsam als ob sich der Ankettungspunkt, d.h. der Himmelspol von dem Stierschenkel in der Richtung zum Nilpferd im Laufe der Jahrhunderte verschoben habe. Tatsächlich hat sich der Himmelspol in dieser Zeit vow Grossen Bären weg zum Kleinen Bären verschoben. Bei den Chinesen liegt, wie L. DE SAUSSURE nachgewiesen hat, ein ähnlicher Vorgang vor; dort wurde im Laufe der Jahrtausende der Himmelspol immer wieder zu anderen Sternen hin verlegt, die der tatsächlichen Bahn des Nordpoles nahe liegen. Demgemäss wäre es nicht unwahrscheinlich, wenn die Ägypter durch die Lageveränderung des Haltepunktes der Kette den veränderten Umständen am Himmel Rechnung getragen hätten. Allerdings können diese Darstellungen der Polgegend, wegen ihrer von vielen Forschern festgestellten Ungenauigkeit, nur einen rohen Anhalt geben.

Die Identifizierung der Sternbilder wurde in der letzen Zeit von R. A. BIEGEL (6) und A. POGO (*Isis* XIV) versucht. BIEGEL berechnete für 196 Sterne der 2.-6. Grösse die Örter für 1300 v. Chr. und glaubte aus der Vergleichung der daraufhin entworfenen Sternkarte mit der Darstellung im Sethos-Grabe einzelne Sternbilder ermitteln zu können. Diese Feststellungen sind jedoch wenig sicher, da die gegenseitige Lage und das Aussehen der Sternbilder auf den Darstellungen sehr wechseln; POGO versuchte einige Sternbilder mit Hilfe einer Himmelskugel von 15 cm Durchmesser zu identifizieren. Auch dieser Versuch erscheint wenig aussichtsreich. Will man sich die langwierigen Berechnungen der Örter der Sterne für so abgelegene Zeiten ersparen, so kann man mit grossem Vorteil die Sterntafeln von Neugebauer (7) benützen, die für 309 Sterne ihre Örter von 100 zu

(6) R. A. BIEGEL, Zur Astrognosie der alten Ägypter. *Dissertation*, Zürich 1921.

(7) PAUL V. NEUGEBAUER, Tafeln zur astronomischen Chronologie, I-III, Leipzig 1914-25.

100 Jahren von —4000 bis +1900 hinreichend genau geben. Aber selbst diese Tafeln kommen für solche Darstellungen wie im Grabe des Senmut nicht in Betracht, da die Malereien zu ungenau sind, eher noch für die Dekanlisten der Gräber des MSAHITI und zu Siut und für die Kulminationslisten. Hier könnten sie wohl mit Vorteil verwendet werden; denn aus diesen Listen geht hervor, dass bereits die einzelnen Teile der Sternbilder, z.B. beim Nilpferd der Fuss, das Bein, der Schenkel, die Brust, das Diadem und die Federn gemäss ihrem Meridiandurchgange festgelegt waren. Damit lässt sich natürlich mehr anfangen als mit den rohen Malereien in den Gräbern, die zudem in dem Grabe des SENMUT nicht fertig geworden sind.

Will man die Sternbilder der Nordpolgegend auf Grund der Darstellungen ermitteln, so liesse sich Folgendes angeben : der Stier oder Stierschenkel stellt den Grossen Bären dar, das Nilpferd Isis, das vom Pol aus gesehen dem Stier gegenüber liegt, den Kleinen Bären, das dahinter stehende Krokodil die Sternreihe τ bis ι im Drachen und der Pflock oder Messer α und i im Drachen.

Auf allen diesen Bildern steht die Polgegend gegenüber den Dekanen Orion und Sirius, welche die Reihe der Dekane beschliessen. Diese Dekane sind die einzigen, die uns von den Dekanen bekannt sind; denn die Dekane haben im Laufe der Jahrtausende ihren Namen und vielleicht auch das Sternbild gewechselt, so dass ihre eindeutige Festlegung nicht möglich ist. Wie die Dekane zu den verschiedenen Zeiten hiessen, geht aus der folgenden Liste hervor, welche für das 19-20. und 30. Herrscherhaus die Reihenfolge der Dekane, ab Sirius, und ihre Gleichsetzung mit den Dritteln der griechischen Tierkreiszeichen gibt. Die 1. Spalte enthält die Dekane in Grabe des MSAHITI, soweit sie mit den Dekanen der späteren Zeit übereinstimmen; die 2.-4. Spalten enthalten die Aufeinanderfolge in den Gräbern des 19. und 20. Herrscherhauses mit den ägyptischen Namen der Dekane und der Übersetzung. In der 5. Spalte ist die Reihenfolge in dem 30. Herrscherhause, im 4. Jahrhundert v. Chr., mitgeteilt. Die letzten Spalten enthalten die Gleichsetzung mit den Dritteln der Tierkreiszeichen und die damals gebräuchlichen ägyptischen Namen der Sternbilder, soweit sie von den früher gebräuchlichen abwichen. Diese Listen zeigen deutlich, dass die Aufeinanderfolge der Dekane nicht völlig der Aufeinanderfolge der Tierkreiszeichen

Liste der ägyptischen Dekane. (8)

1	2	3	4	5	6	7
	1	Tpa-kenmut	Spitze des Kenmut	6	Krebs 2	Schildkrö-
1	2	Kenmut	Kenmut	1	Krebs 3	[ten šit
3	3	chr-chpd-kenmut	Nabel des Kenmut	2	Löwe 1	
	4	ḫā-t'at	Anfang des Tat	3	Löwe 2	
	5	pḫu-t'at	Ende des Tat	4	Löwe 3	
6	6	tomet-ḫrt	Oberer Kasten }	5	} Jungfrau 1	
7	7	tomet-chrt	Unterer Kasten }			
8	8	ušti	—	6	} Jungfrau 2	
	9	bekati oder	—	7		
9		sibu-maḫu	Vollsterne	8	Jungfrau 3	áposot
10					Wage 1	sebches
	10	tpā-chont	Spitze des chont	9	Wage 2	
11	11	chont-ḫrt	Oberer chont	10	Wage 3	
12	12	chont-chrt	Unterer chont	11		
13	13	themas n chont	Gestell des chont	12		
	14	sapt chonnu	Ränder des chonnu	13	Skorpion 1	
	15	ḫı-āb-ua	Der mitten im Schiff	14	Schütze 1	
	16	šešmu	Die Presse	15	Skorpion 2	
					Skorpion 3	si-sešmu
					Schütze 2	sešmu
18	17	kenemu		16	Schütze 3	
19	18	smad	Hälfter (im Schaf)	18	Steinbock 1	
	19	tpā-smad	Spitze des Hälfters	17		
20	20	sart	Schaf	19	Steinbock 2	
21	21	sisi-sart	Die beiden... des Schafes	20	Steinbock 3	
22	22	chr-chpd-sart	Nabel des Schafes	21		
23	23	tpā-chuchu	Spitze der 2 Glänzenden	22	Wassermann 1	
25	24	chuchu	Die 2 Glänzenden	23	Wassermann 2	
					Wassermann 3	tpā-biu
	25	bibi	Die 2 Seelen	24	Fische 1	biu
					Fische 3	tpi-biu
	26	chont-ḫrt	Oberer chont	25	{ Fische 2	
					{ Widder 1	
	27	ḫr-āb-chont	Mitte des chont	26		
	28	chont-chrt	Unterer chont	27	Widder 2	
26	29	kod	—	28		
	30	sisi-kod	Die beiden des Kod	29	Widder 3	
27	31	chau	Die Tausende	30	Stier 1	
28	32	ārīt	—	31	Stier 2	
	33	ater saḫ	7 Sterne des Orion	32	Zwillinge 1	thos ālq
32	34	ûaret	Fuss des Orion	33	Zwillinge 2	
30	35	rum chr saḫ	Oberarm des Orion	34	Stier 3	
					Zwillinge 3	pḫu-ḫor
34	36	Sopdet	Sirius	35	Krebs 1	

(8) E. Zinner, Geschichte der Sternkunde, Berlin 1930, S. 18.

entspricht. Ausserdem ergibt sich, dass von den im 3. Jahrtausend vorhandenen Dekanen der Spalte 1 nur ein Teil im nächsten Jahrtausend wiederkehrt und dass sich im letzten Jahrtausend wieder neue Namen einstellten. Die Gleichsetzung der Dekane mit den Tierkreiszeichen bedeutet nicht, dass die Dekane etwa die Sonnenbahn darstellen sollten; vielmehr waren sie im Unterschied zu den Tierkreiszeichen auf den Äquator bezogen.

Bemerkenswert ist das zweimalige Vorkommen des Sternbildes « chont » als 10.-14. und 26.-28. Dekan, also an genau gegenüberliegenden Stellen des Dekankreises. Da die entsprechenden Tierkreiszeichen Waage und Widder sind, so liegt die Annahme nahe, dass dieses Sternbild in der Dekanreihe den Schnitt des Bandes der Dekane mit dem Bande des Tierkreises darstellte. Diese beiden Schnittstellen stehen gleichweit ab vom Sirius, dem Schluss der Dekane, und dem Dekan 18 « Der Hälfter », der offenbar durch seinen Namen anzeigen sollte, dass er die mit Sirius schliessende Reihe der Dekane in zwei gleiche Teile zerschneidet. Durch diese vier Sternbilder : Sirius, Hälfter, und die beiden Schnittstellen des Tierkreises wurden in der Dekanreihe bereits im 2. Jahrtausend vier bevorzugte Stellen unterschieden, die den Jahrpunkten entsprachen und in Naturjahre durch die Frühaufgänge (heliakischen Aufgänge) und im Wandeljahr durch die mitternächtlichen Meridiandurchgänge der betreffenden Dekane gekennzeichnet wurden. Damit war der Anfang gemacht zu der später so wichtigen Unterscheidung der 4 Jahrespunkte im Jahre und den entsprechenden Stellen in der Sonnenbahn.

Ausser dieser Einteilung der Dekanreihe lässt sich aus den Namen der Dekane noch nicht entnehmen, welchen Sternbildern sie entsprechen sollten; denn wir wissen nicht, welcher Teil des Horizontes bei der Aufeinanderfolge der aufgehenden Sternbilder berücksichtigt wurde. Allerdings geben uns die Listen der Dekane in den Gräbern des MSAHITI und zu Siut genauere Unterlagen als das Grab des SENMUT; aber auch dort sind manche Listen nicht vollständig oder legen die Annahme nahe, dass die Maler nachlässig gearbeitet haben. Dasselbe ist der Fall mit den Bildern in den Tempeln zu Dendera und Edfu, wo zudem die altägyptischen Sternbilder derart mit griechischen und babylonischen Sternbildern vermengt sind und offenbar auch

Fehler unterlaufen, dass uns dadurch keine Hilfe entsteht. Nur lässt sich aus der Einreihung der Tierkreiszeichen im rechteckigen Gemälde zu Dendera folgende Anordnung der nicht zu den Dekanen gehörigen ägyptischen Sternbilder feststellen :

Zum Widder ein Hund, Rücken an Rücken mit einem Affen, auf dessen Haupt ein Sperber; zum Stier ein löwenköpfiger Mann mit Ziegenkopf in der Hand; zu den Zwillingen ein Sperber auf einer Stange; zum Löwen ein sitzender Mann mit Krone und Geissel, Frau mit Geissel; zur Jungfrau der stierköpfige Pflüger Bootes; zur Wage ein stehender Zentaur mit 2 Lampen in der Hand, sitzende Gestalt in einer Scheibe, stehende Gestalt mit Szepter in einer Scheibe; zum Skorpion ein Schakal auf einem Pflug; zum Schützen eine Barke; zum Steinbock ein sperberköpfiger szeptertragender Mann auf einer Gans, kopfloser Mann; zu den Fischen eine Frau in einer Scheibe mit einem Schwein in der Hand.

Ausserdem lassen sich auf dem Rundbilde zu Dendera noch folgende Sternbilder feststellen : Vogel, Schützin, Seelöwe, Fisch unter dem Wassermann, Auge in einer Scheibe, Fuchs oder Schakal, sitzender sperberköpfiger Gott mit Szepter und mit Sonnenscheibe auf dem Haupt in einer Barke, sitzende Anubis, sitzende Gestalt mit Geissel, kopfloses Tier, Widder auf einem Stierschenkel.

Ein Fortschritt in der Ermittelung der ägyptischen Sternbilder liesse sich dann erzielen, wenn es möglich wäre, die in den Sternlisten (Brugsch S. 187-190) der Gräber von Ramses VI. und Ramses IX., die im 12. Jahrhundert herrschten, vorkommenden Sternbilder zu identifizieren. Gemäss der Untersuchung von Bilfinger (9) folgen aufeinander : Doppelstern-Spitze, Doppelstern, Wassersterne, Löwe-Kopf, Löwe-Schwanz, Die vielen Sterne, Lautenträger, Mena-Vorläufer, Mena, Mena-Nachfolger, Nilpferd-Fuss, Nilpferd-Bein, Nilpferd-bah, Nilpferd-Schenkel, Nilpferd-Brust, Nilpferd-Diadem, Nilpferd-Federn, Necht-Federnspitze, Necht-Federn, Necht-Kehle, Necht-Brust, Necht-Rücken, Necht-Bein, Necht-Schekes, Necht-Schemel, Ari, Gans-Kopf, Gans-Rumpf, Schu, Sara, Sahu-Spitze, Sahu, Sothis, nach Sothis. Anscheinend handelt es sich dabei um die Aufeinanderfolge von Sternbildern bei ihrem Durchgange durch den Meridian.

(9) Bilfinger, Die Sterntafeln von Biban-el-Moluk, Stuttgart 1891.

Eine genaue Festlegung der einzelnen Sternbilder war noch nicht möglich; offenbar liegen auch hier Fehler der Handwerker vor. Andererseits hat L. BORCHARDT (a. a. O. S. 58) nachgewiesen, dass die ägyptischen Wasseruhren nicht genau gingen, sodass mit ihrer Hilfe sich keine genauen Listen der Meridiandurchgänge aufstellen liessen.

Ausser den Sternbildern Orion (Sahu) und Sirius (Sothis), die den Schluss der Liste bilden, enthält die Liste das ständig sichtbare Nilpferd und den Löwen, der offenbar dem griechischen Löwen entsprach, wegen seines Abstandes vom Sirius und weil sein Kopf dem Schwanze etwa 1 Stunde vorausgeht, wie beim griechischen Sternbilde. Das Sternbild Mena bedeutet wohl den Pflock oder das Messer in der Hand des Nilpferdes; seine Lage zu diesem Sternbild ist so wie auf den Polbildern.

In den Dekanlisten lässt sich der Unterschied zwischen der Khiti-Gruppe und der Sethos-Gruppe nicht nachweisen. Dagegen gelang es POGO (*Isis* XIV, S. 320) bezüglich der zu den Dekanen gehörigen Götter eine Verschiedenheit der Angaben bei SENMUT und Ramesseum gegenüber den Angaben bei SETHOS I. festzustellen.

(Remeis-Sternwarte, Bamberg.) ERNST ZINNER.

Zum Problem der Identifikation der nördlichen Sternbilder der alten Aegypter

Kritik des astronomischen Teiles der Dissertation *Zur Astrognosie der alten Ägypter* von REBEKKA ALEIDA BIEGEL (Zürich, 1921); der die mythologische Deutung behandelnde Teil wird nicht besprochen.

Der BIEGELsche Identifikationsversuch führt zum Vergleich von zwei Liniennetzen, 6 und 7. Bei der Herstellung des Liniennetzes 6 hat R. A. BIEGEL u.a. angenommen, dass den Ägyptern der XIX. Dynastie Himmelsgloben bekannt waren, und sie hat dementsprechend die SETI-Darstellung als Spiegelbild behandelt; trotzdem die Knotenpunkte des Liniennetzes 6 den kleinen Kreisen an den Gelenken u.s.w. der SETI-Figuren entsprechen sollen, ist einerseits ein Teil dieser Kreise übersehen worden, andererseits wurden Kreise auch dort angenommen, wo sie nicht vorhanden sind. Bei der Herstellung des Liniennetzes 7 hat R. A. BIEGEL eine unter Berücksichtigung von Präzession und von Eigenbewegungen hergestellte Polarkarte für —1300 benutzt, welche die Sterngruppen in einer den Ägyptern völlig fremden Verzerrung darstellt; bei der Wahl der Knotenpunkte des Liniennetzes 7 sind helle Sterne in unmittelbarer Nähe des Pols unbenutzt geblieben, während weit entlegene kaum sichtbare Sterne berücksichtigt worden sind.

Die Herstellungsweise der Liniennetze 6 und 7 erklärt ihre Ähnlichkeit. Die Sterne in Draco und in Ursa Minor bleiben unidentifiziert; bloss 4 von den 7 Mascheti-Sternen der Ursa Maior werden dem Stier zugeteilt; das Nilpferd mit dem Krokodil wird in Bootes, Corona und Serpens gesucht und gefunden — u.s.w. Die Orientierung der Liniennetze 6 und 7 entspricht der unteren Kulmination von Ursa Maior, bei der die meisten der in das Liniennetz 7 aufgenommenen Sterngruppen unter dem altägyptischen Horizont verweilten.

Die Grundlagen, der Gedankengang und die Ergebnisse des Identifikationsversuches von R. A. BIEGEL werden abgelehnt.

1. *Einleitung.* Vereinzelte Identifikationsversuche von Dekanen und nördlichen Sternbildern der alten Ägypter sind bereits im XIX. Jahrhundert gemacht worden. A. ROMIEU (1) hat beispielsweise den 18. Dekan Smat auf rechnerischem Wege mit α Aquilae in Beziehung gebracht; natürlich hat er dabei die Präzession berücksichtigt.

Die Berücksichtigung der Präzession lässt sich leider bei den

(1) *Zeitschr. f. ägypt. Sprache*, 6, 136-146, 1868.

Ägyptologen, die sich mit astronomischen Problemen befassen, nicht immer nachweisen. So können wir z.B. in den *Annales du Service des antiquités de l'Égypte*, 1900, vol. 1, p. 82, die folgenden Betrachtungen (2) finden : « ... pendant les milliers d'années qui séparent la rédaction de ces catalogues il a dû se produire des modifications dans l'aspect du ciel ; certaines étoiles ont pu s'éloigner de la constellation à laquelle on les avait rattachées, ce qui a forcé à inventer de nouveaux groupements. » An Präzession ist hier offenbar nicht zu denken; vielleicht sind die Eigenbewegungen der Sterne gemeint, auf die wir noch zurückkommen werden. Ein anderes Beispiel (3) ist in den *Nachrichten der Gesellschaft der Wissenschaften zu Göttingen, phil.-hist. Klasse*, 1919, S. 306, zu finden : « Während der Tierkreis die Einteilung der Ekliptik darstellt, stellen die Dekane offenbar den Äquator dar. Dazu passt, dass unter ihnen seit alters auch Teile des Orion erscheinen, dessen Gürtel vom Äquator durchschnitten wird. » Die Dekane sind natürlich Sterne und Sterngruppen des Äquatorialgürtels, da sie in der Nähe des Ostpunktes des Horizonts aufgehen; der Himmelsäquator entsprach jedoch vor 5000 Jahren der damaligen Lage der Himmelsachse, und verlief demgemäss nördlich von Aldebaran, am Prokyon, südlich von Sextans, Crater, Corvus, Virgo und Libra, nördlich von Antares, durch Equuleus und Pegasus zu den Plejaden und zum Frühlingspunkt im Taurus. Nicht nur der Gürtel des Orion, sondern auch seine Schultern befanden sich damals südlich vom Äquator. Ich verzichte auf das Anführen von weiteren Beispielen des zähen Glaubens der Ägyptologen an die Unbeweglichkeit des Himmelspols.

Rebekka Aleida Biegel (4) machte den ersten grosszügig angelegten Versuch, die ***nördlichen*** Sternbilder der alten Ägypter zu identifizieren; ihre Untersuchung der Astrognosie der Ägypter erstreckt sich nicht auf den Äquatorialgürtel der Dekane. Da sie ausser der Präzession auch die Eigenbewegungen berücksichtigt hat, schalte ich hier einige Bemerkungen über den Einfluss dieser letzteren ein.

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(2) G. Daressy. *Une ancienne liste des décans égyptiens.*

(3) Kurt Sethe. *Die Zeitrechnung der alten Aegypter im Verhältnis zu der der anderen Völker.*

(4) *Zur Astrognosie der alten Ägypter.* Inaugural-Dissertation. Begutachtet von Herrn Prof. Dr. A. Wolfer. Zürich 1921.

2. *Eigenbewegung*. Mit der Ausnahme von α Centauri und von fünf Sternen 4. bis 6. Grösse, (5) sind die Sterne, deren jährliche Eigenbewegung 3 Bogensekunden übersteigt, dem blossen Auge nicht sichtbar. Berücksichtigt man die hellen Sterne, deren jährliche Eigenbewegung 1″ übersteigt, so kommen bloss α Centauri ($\mu = 3''.68$), Arcturus ($\mu = 2''.29$), Sirius ($\mu = 1''.32$) und Prokyon ($\mu = 1''.24$) in Betracht.

Wenn es sich um die genaue Berechnung der Zeit des Auf- und Unterganges oder auch der Kulmination eines dem Sonnensystem benachbarten Dekansternes wie Sirius, Prokyon oder Altair handelt, muss die Eigenbewegung berücksichtigt werden; bei der Verwendung des Ergebnisses einer solchen genauen Berechnung wird man selbstverständlich die recht ungenauen Beobachtungsmethoden der alten Ägypter nicht ausser acht lassen. Wenn es sich dagegen um die Umrisse einer als mythologische Figur betrachteten Sterngruppe handelt, so spielt die Eigenbewegung eines hellen Sternes überhaupt keine Rolle. Unter den 196 Sternen des BIEGELschen Verzeichnisses hat Arcturus the grösste Eigenbewegung, die einen halben Grad per millennium übersteigt, die jedoch das Aussehen der Bootesgruppe im Laufe der Jahrtausende kaum merklich geändert hat.

Ein ZEISS-Planetarium oder ein als Präzessionarium verwendeter moderner Himmelsglobus können demgemäss sowohl für die Beobachtung von Auf- und Untergängen von Dekanen als auch für die Identifikation der Umrisse der nördlichen Sternbilder empfohlen werden.

3. *Das* BIEGEL*sche Sternverzeichnis*. Die im Jahre 1912 veröffentlichten Tafeln von P. V. NEUGEBAUER (6) enthalten ein Verzeichnis von 309 Sternen, deren Positionen von hundert zu hundert Jahren für −4000 bis +1900 gegeben sind; das Verzeichnis ist vollständig für die Sterne bis zur 3. Grössenklasse; in einem 40 Grad breiten Ekliptikalgürtel sind nicht nur die Sterne bis zur 4. Grössenklasse berücksichtigt, sondern auch einige schwächere Sterne.

Das BIEGELsche Verzeichnis von 196 Sternen hat die Positionen von 35 Sternen dem NEUGEBAUERschen Verzeichnis entnommen;

(5) 61 Cygni ($\mu = 5''.20$), ϵ Indi ($\mu = 4''.70$), o^2 Eridani ($\mu = 4''.08$), μ Cassiopeiae ($\mu = 3''.76$) und e Eridani ($\mu = 3''.16$).

(6) PAUL V. NEUGEBAUER. Tafeln zur astronomischen Chronologie I. Sterntafeln von 4000 vor Chr. bis zur Gegenwart. Leipzig 1912.

von diesen 35 Sternen weisen 16 Sterne für —1300 eine Deklination von +12° bis +30° auf, kommen also für das damalige Ägypten als nördliche Sterne überhaupt nicht in Betracht. Die 161 Sterne, für die R. A. BIEGEL die Positionen fur —1300 berechnet hat, enthalten 108 Sterne, deren Grösse zwischen 4.5 und 5.8 fällt, die also zu schwach sind, um als Anhaltspunkte bei einer Identifikation von Sternbildern dienen zu können. Ihr Verzeichnis enthält sogar Sterne, für deren Bezeichnung es keine BAYERschen Buchstaben und keine FLAMSTEEDschen Nummern gibt (7).

Die Grenzen des in dem BIEGELschen Sternverzeichnis enthaltenen Himmelsgebietes sind leider so gewählt, dass es weder für eine streng wissenschaftliche Untersuchung der polnahen Sterngruppen, noch für eine etwaige Identifikation der Dekangestirne des Äquatorialgürtels verwendbar ist. « Als Bereich der Karte wählte ich den Himmelsabschnitt zwischen Rektaszension 90° — 240° und Deklination 15° — 80° für die Epoche + 1900. » Als Ergebnis dieser Wahl liegt die Polgegend — sowohl die jetzige als auch die altägyptische — am Rande, nicht in der Mitte des BIEGELschen Himmelsabschnittes. Als etwaiges Hilfsmittel bei Identifikationsversuchen von Dekangestirnen ist das BIEGELsche Sternverzeichnis ebenfalls aussichtslos, denn trotzdem es bis in die Nähe des (8) Äquators von —1300 reicht, enthält es nur einen Teil der für die Dekangestirne in Betracht kommenden Himmelsgegend.

Das Sternverzeichnis ist nicht einmal frei von Rechenfehlern. So ist die —1300 Position von ζ Ursae Minoris offenbar nicht $\alpha = 117°.89$ und $\delta = 100°.56$, sondern wahrscheinlich $\alpha = 297°.89$ und $\delta = 79°.44$.

4. *Die kleinen Kreise der* SETI-*Darstellung*. Die Darstellungen des nördlichen Himmels im Grabe SETI I., im Ramesseum und in zwei Königsgräbern des XX. Herrscherhauses bilden die Grundlage der Identifikationsversuche R. A. BIEGELS — und zwar

(7) BIEGEL, S. 9 : « ... dort, wo dieser (der Stern) auch im Boss-Katalog keinen Namen aufweist, ist er durch ein Kreuzchen bezeichnet. » An eine Verwendung der Boss-Nummer hat sie offenbar nicht gedacht. Ihre Sterne Nr. 25, 53, 68 und 88 sind Boss 1879, 2437, 2570 bzw. 2802.

(8) Das Verzeichnis beginnt mit den Sternen 4.4. Grösse ν und ζ Orionis, deren Deklination (für —1300) + 8°.19 bzw. +9°.19 betrug, diese Sterne kulminieren — sogar in Südägypten — auch jetzt noch südlich vom Zenit !

nicht etwa die WEIDENBACHschen Zeichnungen (9), sondern die entsprechenden Skizzen im *Thesaurus* von BRUGSCH. (10) Diese Skizzen geben die allgemeine Anordnung und Form der dargestellten Gottheiten ziemlich genau wieder, sie gehen jedoch auf Einzelheiten nicht ein, und sie lösen den Zusammenhang der nördlichen Sternbilder mit den benachbarten Teilen der Darstellungen auf. Die BURTONschen Lichtbilder der SETI-Decke wurden von dem Metropolitan Museum (11) erst drei Jahre nach dem Erscheinen der BIEGELschen Arbeit veröffentlicht.

Die kleinen Kreise an den Schultern, Knien usw. der auf der SETI-Decke dargestellten Gottheiten spielen in der BIEGELschen Identifikation eine sehr wichtige Rolle. Solche Kreise sind auch an den Schultern, Knien usw. der Gottheiten zu sehen, die in den beiden Prozessionen von Diskusträgern der vollständigen SETI-Darstellung einherschreiten; die Verwendung von kleinen Kreisen auf der SETI-Decke kann also auch rein symbolisch-dekorativ sein, und braucht nicht unbedingt mit der gegenseitigen Lage von hellen Sternen in Beziehung zu stehen.

R. A. BIEGEL vermutet mit Recht, « dass bei der Reproduktion der Zeichnungen » im *Thesaurus* « vielleicht einige jener kleinen Kreise verloren gingen, weil man deren Bedeutung nicht kannte und sie deshalb übersah. » (12) Auch weiss sie, dass bei ERMAN (13) auf der SETI-Darstellung kleine Kreise angegeben sind, die bei BRUGSCH fehlen (14). Sie geht nun einen Schritt weiter und nimmt bei der Herstellung des roten Liniennetzes (ihre Zeichnungen 6*a* und 6*b*) an, dass die Linien « ihre Endpunkte in Gelenken, Kopf, Herz usw. der Figuren haben müssen. Wahrscheinlich waren auch in diesen Endpunkten Kreise, welche übersehen wurden. (15) » Ein Vergleich des roten Liniennetzes (6*a* oder 6*b*)

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(9) Vgl. *Isis*, 14, 301-302, 1930.

(10) H. BRUGSCH. Thesaurus inscriptionum aegyptiacarum, I, 124-126. Leipzig, 1883.

(11) *Bulletin of the Metropolitan Museum of Art*, 18, 283-286. New York, 1923.

(12) BIEGEL, S. 14.

(13) A. ERMAN. Aegypten und aegyptisches Leben im Altertum, I, 466. Tübingen, (1885).

(14) ERMAN verweist bei seiner Skizze der « Sternbilder am Nordpol des Himmels », S. 466, auf LEPSIUS, *Denkmaeler*, III, 137. Leider hat sich R. A. BIEGEL nicht die Mühe gegeben, das Riesenfolio aufzuschlagen.

(15) BIEGEL, S. 15.

mit der WEIDENBACHschen Zeichnung oder den BURTONschen Lichtbildern zeigt, dass manche Kreise bereits von den Malern der SETI-Decke « übersehen wurden ». Die Dreiecke an den Hinterpfoten des Nilpferdes oder am stehenden Krokodil verdanken z.B. ihre Anwesenheit im roten Liniennetz 6*a* oder 6*b* nicht etwa dem Vorhandensein oder dem Fehlen von kleinen Kreisen an den entsprechenden Stellen der SETI-Darstellung, sondern dem Wunsch, in ihnen die Sterne τ, υ, η und π, ζ, o Bootis und β, κ, γ Serpentis zu erkennen. Auch die beiden unteren, überhaupt keinen Gelenken entsprechenden Ecken des roten Vierecks im Stier sind nur dadurch zu erklären, dass für β und γ Ursae Maioris Anhaltspunkte gefunden werden mussten. Diese Willkür in der Wahl der Endpunkte des roten Liniennetzes 6*a* oder 6*b* ist jedoch verzeihlich, wenn man die unzulässige Spiegelbild-Orientierung des Liniennetzes berücksichtigt.

5. *Spiegelbild-Orientierung der* SETI-*Darstellung*. Wir haben keinen Grund anzunehmen, dass die Ägypter der XIX. Dynastie — oder eigentlich noch älterer Zeiten, aus denen die Vorbilder der Darstellungen in den Gräbern des Neuen Reiches stammen — Himmelsgloben kannten. Auch steht es keineswegs fest, dass ein primitiver Himmelsglobus die Gestirne so darstellt, wie sie vom Mittelpunkt des Globus aus gesehen am Himmel erscheinen : wenn man entweder den Globus in der umgekehrten Richtung

Fig. 1 Skizze des Siebengestirns als Schenkel. Nach der KHITI-Darstellung. Vgl. E. CHASSINAT et CH. PALANQUE. Mémoires de l'Institut français d'archéologie orientale du Caire, v. 24, pl. XXV.

zu drehen oder die Sternbilder in Spiegeldarstellung zu betrachten hat, kann man sich sowohl für den « retrograden » als auch für den « direkten » Himmelsglobus entscheiden. Es unterliegt jedoch keinem Zweifel, dass die mythologischen Sternbilder bei der

Betrachtung des gestirnten Himmels und nicht eines Himmelsglobus entstanden sind.

Wenn ein sternkundiger Ägypter vor 4000 Jahren sein « Gesicht auf den Lauf der Gestirne » richtete und sein « Auge in das Sternbild des Schenkels » — hoch über dem Pol, nicht tief am Horizont — eintreten liess, da war rechts vom Nordpunkt des Horizonts eine nach links schreitende Gottheit zu sehen, auf einen spitz nach unten zulaufenden Gegenstand gestützt, den Kopf stark nach vorn gebeugt. (16) Die Anordnung der sieben Sterne im Schenkel — vgl. Abb. 1 — ist uns aus den Siut-Sarkophagen bekannt; (17) die Entwicklung des Schenkels zum Stier-Ovoid (Kopf links, Spitze rechts) in der SENMUT- und in der Ramesseum-Darstellungsweise, zum vollen Stier (Kopf links) in den Gräbern SETI I. und der XX. Dynastie lässt keinen Zweifel daran, dass der nach links gerichtete Mascheti in der oberen — nicht in der unteren — Kulmination dargestellt ist. Die bei R. A. BIEGEL auf Zeichnung 4 wiedergegebene Spiegeldarstellung des nördlichen Himmels aus einem Grabe der XX. Dynastie (18) ist offenbar eine aus zeichnerischen Rücksichtigen falsch orientierte Kopie des der Zeichnung 3B zugrunde liegenden richtig orientierten Originals (19).

« Zeichnung 6*a* ist eine Wiederholung der Zeichnung 1, nur spiegelbildlich reproduziert, um die Identifikation durchführen zu können. Die Sternkarten stellen den Himmel so dar, wie er einem im Mittelpunkt der Himmelskugel stehenden Beobachter erscheint, für den also die Sterne sich an der Innenseite befinden. Die Zeichnungen hingegen scheinen einem Himmelsglobus entnommen zu sein, wo die Sterne an der Aussenseite angebracht sind, und wo der Beobachter als auswärtsstehend gedacht wird. (20) » Es ist absolut unzulässig, die SETI-Darstellung und die anderen älteren Darstellungen des Neuen Reiches als Spiegelbilder zu behandeln und anzunehmen, dass sie einem Himmels-

(16) Vgl. *Isis*, 14, 309-312, 1930.

(17) Vgl. P. LACAU, *Sarcophages antérieurs au nouvel empire*, II, 110 : « ... la constellation de la grande ourse figurée par la jambe couverte de sept étoiles... » E. CHASSINAT et CH. PALANQUE, *Mémoires de l'Institut français du Caire*, v. 24, pl. XXV, p. 119, 148, 193.

(18) Vgl. BRUGSCH, *Thesaurus*, I, 126.

(19) Ibid., 125.

(20) BIEGEL, S. 14-15.

globus entnommen sind. Ein Identifikationsversuch, der auf einer phantastischen Hypothese mühsam errichtet wird, führt natürlich zu absurden Ergebnissen.

6. *Die* BIEGEL*sche Sternkarte.* Die Annahme, dass die ägyptischen Darstellungen einem Himmelsglobus entnommen sind, « wo die Sterne an der Aussenseite angebracht sind, und wo der Beobachter als auswärtsstehend gedacht wird », führt nun R. A. BIEGEL zu einer weiteren, noch gewagteren Hypothese. Versetzen wir uns, für einen Augenblick, in die Werkstätte des sternkundigen Künstlers, der die erste Skizze entworfen hat, die « einem Himmelsglobus entnommen zu sein » scheint und deren Nachbildungen in den Gräbern des Neuen Reiches zu finden sind. Wird er sich damit begnügen, die Sternbilder eines Teiles des nördlichen Himmels so darzustellen, wie sie dem Auge auf der gewölbten Oberfläche seines Globus erscheinen? Nein. Er nimmt sein Jahrbuch, welches die Rektaszensionen und Deklinationen der Sterne der ersten sechs Grössenklassen fur die Epoche 2000 v. Chr. enthält und entwirft eine Polarkarte : die Verzerrung der Sternbilder ist dann so gross, dass sie als befriedigende Grundlage für die (uns aus den Königsgräbern bekannte) Darstellung der nördlichen Sternbilder gelten kann. Verlassen wir nun die Werkstätte des sternkundigen Künstlers. Den Ägyptern des 3. und 2. Jahrtausends fehlten nicht nur die Mittel für die Bestimmung von Rektaszensionen und Deklinationen, sondren auch der Begriff der äquatorialen Koordinaten war ihnen fremd : die Einteilung der äquatorialen Zone in 36 Dekangebiete hat die Ägypter nicht zur Umspannung des Himmels mit einem sich in 24 Stunden um den Pol drehenden Netze geführt. Von Polarkarten und von homalographischer Projektion wussten sie leider auch nichts.

« Man kan vermuten, dass die parallelen Linien oben und unten am Bilde als Parallelkreise aufzufassen sind, die Linien senkrecht darauf als Meridiane. Diesem Gedankengang folgend machte ich zwei Versuche. Zuerst wurde die Sternkarte transformiert dadurch, dass ich die Sternbilder in ein quadratisches Netz einzeichnete. Die Verzerrung in der Nähe des Nordpols wurde aber zu gross. Dann versuchte ich, die ägyptischen Abbildungen in eine Polarkarte zu übertragen. Als seitliche Begrenzung wurden die Meridiane von 30° und 210° gewählt, die obere und untere Grenzlinie in die Parallelkreise von 25° und 80° gelegt. Natürlich

wurde durch diese Übertragung die untere Hälfte (21) der Zeichnung stark verzerrt, wodurch das Bild an Anschaulichkeit verlor. Das erwünschte Ziel, ein einfaches zur Deckung bringen von Bild und Sternkarte wurde jedoch durch die Transformation nicht erreicht. Schliesslich musste ich noch den Plan aufgeben, die Sternkarte in homalographischer Projektion darzustellen... » (22)

Die Vermutung, dass die parallelen Linien oben und unten am Bilde (SETI-Darstellung) als Parallelkreise aufzufassen sind, ist unzulässig. Die Deklinationskreise — von denen die alten Ägypter nichts wussten — sind ausgesprochene konzentrische Kreise am Pol; erst in der Nähe des Äquators bilden sie mit den Rektaszensionskreisen ein nahezu « quadratisches Netz »; die alten Ägypter kannten den Ortsmeridian, in dem die Gestirne kulminierten — an ein sich mit dem Himmel drehendes Koordinatennetz scheinen sie damals leider noch nicht gedacht zu haben. Was nun die parallelen Linien oben und unten am Bilde betrifft, so stellt die untere Linie der SETI-Darstellung vielleicht den nördlichen Horizont (23) dar, keineswegs jedoch einen rektifizierten Deklinationskreis. Die obere Linie ist einfach der mittlere Teil einer Grenzlinie, welche die Namen der Diskusträger von deren Darstellungen auf der nördlichen Deckenhälfte trennt; auch auf der südlichen Deckenhälfte gibt es eine analoge Begrenzungslinie unter den Dekanennamen, welche ebenfalls keine Beziehung zu einem Deklinationskreise haben kann; R. A. BIEGEL hätte sich die WEIDENBACHsche Zeichnung ansehen sollen. Die den BIEGELschen « Meridianen » entsprechenden « senkrechten Linien » sind auf keiner Darstellung zu sehen; gemeint ist wohl die den verschiedenen Deckendarstellungen gemeinsame Einteilung der Gottheiten in drei Gruppen, die wahrscheinlich den Sternbildern im

(21) Die BIEGELsche Polarkarte und ihre Zeichnung 7 sind so orientiert, dass der Nordpol oben liegt, darunter Ursa Maior in unterer Kulmination (α und β rechts, γ und δ links vom Meridian).

(22) BIEGEL, S. 13.

(23) Der nördliche Horizont ist eine natürliche untere Begrenzungslinie für eine Darstellung von polnahen Sterngruppen. Er wird zu einer notwendigen unteren Begrenzungslinie, wenn der Nordpunkt durch Kulminationsbeobachtungen festgestellt werden soll. Man muss jedoch nicht vergessen, dass auch die Diskusträger auf derselben nördlichen Begrenzungslinie einherschreiten — und dass die Dekanengötter die südliche Begrenzungslinie der SETI-Decke als « Fussboden » bzw. « Wasser » benutzen.

und um den Meridian zur Zeit der oberen Kulmination von Ursa Major entsprechen.

Der Dissertation ist eine Polarkarte beigefügt, welche die *ad hoc* gewählten 196 Sterne des oben besprochenen Verzeichnisses enthält; der Titel lautet : « Sterngruppen in der Nähe des Grossen Bären, Epoche — 1300 ». Auf Zeichnung 7, deren Herstellungsmethode dem Leser nicht verraten wird, die jedoch eine im gleichen Massstab gehaltene Wiederholung der Polarkarte ist, fehlen die Rektaszensionsradien (2h bis 14h) und die konzentrischen Deklinationskreise. Das rote Liniennetz der Zeichnung 7 lässt die hellen Sterne in Draco unberücksichtigt (Ursa Minor fehlt auf Zeichnung 7), benutzt dagegen als Knotenpunkte eine grosse Anzahl von lichtschwachen Sternen, die bei Mondlicht überhaupt nicht zu finden sind und die bei Neumond in der Menge der in das BIEGELsche Sternverzeichnis nicht aufgenommenen lichtschwachen Sterne verloren gehen. « Sämtliche helleren Sterne sind berücksichtigt worden, dazu fast alle schwächeren Sterne im Bereich der Zeichnung » (24)— der erste Teil dieser Angabe ist falsch, der zweite ist leider richtig.

7. *Das Ergebnis des Identifikationsversuches.* Nimmt man ein Blatt Papier, auf dem mehr als hundert Tintenflecke verschiedener Grösse unregelmässig verteilt sind, so ist es leicht ein beliebiges rotes Liniennetz einzuzeichnen, das aus miteinander verbundenen Dreiecken und Vierecken besteht und unbequem gelegene Tintenflecke unberücksichtigt lässt. So ist es denn auch keine Überraschung, dass das rote Liniennetz der Zeichnungen 6*a* oder 6*b* (Spiegelbild der SETI-Darstellung, mit willkürlich angenommenen Knotenpunkten) eine gewisse Ähnlichkeit mit dem roten Liniennetz der Zeichnung 7 (durch Polarprojektion verzerrte Sternkarte) aufweist. Wir haben gesehen, dass R. A. BIEGEL zuerst mit dem Ergebnis unzufrieden war : « das erwünschte Ziel, ein einfaches zur Deckung bringen von Bild und Sternkarte wurde jedoch durch die Transformation nicht erreicht ». Dann aber stellte sie die Zeichnung 7 her : sie entfernte das Koordinatennetz der Polarkarte, sie beseitigte die unbequem am Rande gelegene Ursa Minor, zeichnete das rote Liniennetz ein; die Verzerrung und auch der Massstab sind natürlich unverändert geblieben, sie

(24) BIEGEL, S. 15.

hoffte jedoch dass man die Polarkarte in Zeichnung 7 nicht erkennen wird und dass der Leser höflich genug sein wird, nicht zu fragen : « Wie ist die Identifikationszeichnung 7 entstanden ? » Und trotzdem sie zugeben musste, dass ein Vergleich der Liniennetze 6*a* und 6*b* mit der Polarkarte « das erwünschte Ziel » als nicht erreicht erscheinen liess, findet sie nun, dass « die Übereinstimmung mit den Verbindungslinien der Sternkarte, wie sie in Bild 7 angegeben sind, befriedigend ist. Man muss die Verzerrung der

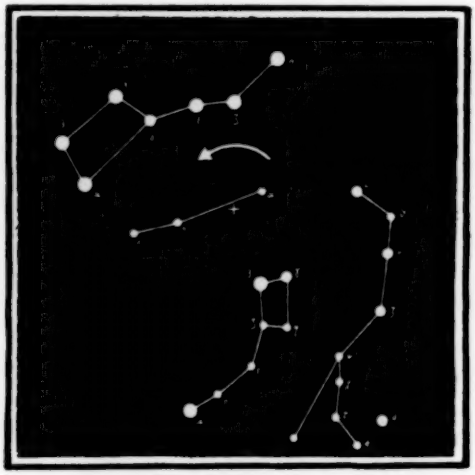

Abb. 2 Skizze der nördlichen Zirkumpolarsternbilder. Draco und Ursa Minor über dem Horizont von Theben, ca. 2000 v. Chr., zur Zeit der oberen Kulmination von ζ Ursae Maioris. Das Kreuz deutet die ungefähre Lage des Pols, der Pfeil die Richtung der täglichen Himmelsdrehung an.

Sternkarte in den unteren Teilen in Betracht ziehen, diese ist besonders gross bei den Nilpferd- und Krokodilgestalten. Betrachtet man diese Gestalten auf einer Karte, welche für diesen Himmelsabschnitt wenig verzerrt ist, so ist die Übereinstimmung noch viel besser... Am wenigsten befriedigend ist die Übereinstimmung bei den Figuren 3 und 8. » (25) « Die Gestalt der Stierhüterin (26)

(25) BIEGEL, S. 15. Es handelt sich bei diesen beiden Figuren um den Diskusträger, der die Zügel halt, und um die Skorpiongöttin. In der SENMUT-Rameseum-Darstellungsweise entspricht ihnen eine einzige Figur, die zügelhaltende, diskustragende Skorpiongöttin. R. A. BIEGEL sucht — und findet — die Skorpiongöttin in der Gegend von 23 h Ursae Maioris.

(26) Gemeint ist Isis als Nilpferd.

deckt sich ungefähr mit unserem Sternbild Bootes, das Krokodil... wird gebildet aus einigen Sternen von Bootes und einigen von Corona Borealis und Serpens. Das Herz des Löwen fällt mit einem Stern (27) unseres Sternbildes der Lynx zusammen, die vordere Klaue identifizierte ich mit f Ursae majoris. (28) Die

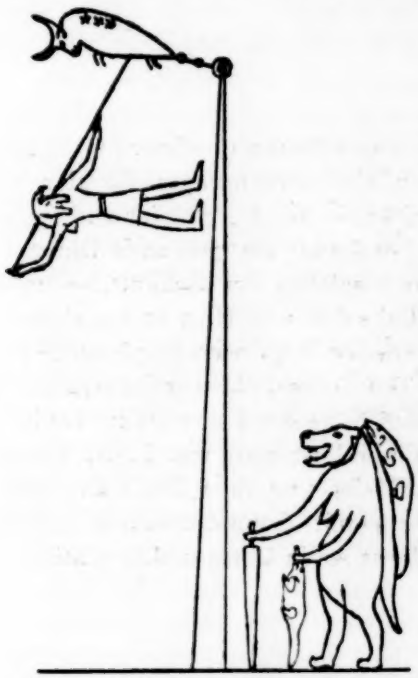

Abb. 3 Skizze der nördlichen Zirkumpolarsternbilder. Nach der SENMUT-Darstellung. Vgl. *Isis*, XIV, pl. 16.

Sternchen, welche auf der ägyptischen Darstellung den Körper umgeben, sind wohl alle Sterne der Lynxgruppe. Die alten Völker betrachteten diese Gruppe als unwichtig, sie wurde nicht benannt. Auch die Hipparcho-Ptolemaeische Sternliste lässt sie unbenannt... Das Messer (?), auf welches das Nilpferd sich stützt, liegt in der Gruppe Coma Berenicae. Auch diese Sterne sind bei HIPPARCHOS unbenannt... » (29)

(27) 27 Lyncis, Grösse 4.9. Auf Zeichnung 7 ist dieses Sternchen durch einen grossen Tintenfleck dargestellt.

(28) Grösse 4.5.

(29) BIEGEL, S. 15-16.

Die Lage der Ursa Maior in den roten Liniennetzen 6*b* und 7 entspricht der unteren Kulmination des Siebengestirns. Der Himmelsabschnitt von 2h bis 14h und von $+25^{\circ}$ bis $+80^{\circ}$ (Epoche -1300), dessen verzerrte Polarprojektion in Zeichnung 7 dargestellt ist, befand sich leider unter dem Horizont von Ägypten zur Zeit der unteren Kulmination von Ursa Maior. Das BIEGELsche Nilpferd im Bootes lag auf dem Rücken oder auf dem Bauch — oder es stand gar auf dem Kopf, — wenn es den Ägyptern sichtbar sein konnte; ein aufrecht stehendes Nilpferd haben die Ägypter in die Bootes-Sterne überhaupt nicht hineinphantasieren können. Wenn ein sternkundiger Ägypter den BIEGELschen Himmelsabschnitt zwischen Ursa Maior und dem Äquatorialgürtel sehen wollte — und zwar am gestirnten Himmel und nicht etwa auf einem Himmelsglobus der Zukunft, — musste er die Zeit der oberen Kulmination von Ursa Maior abwarten und sich auf den Rücken legen, den Kopf nach Norden, die Füsse nach Süden. Hatte er nun das Spiegelbild der bekannten Darstellung der Sternbilder in der Nähe des Nordpols im Gedächtnis und besass er ebensoviel Einbildungskraft wie R. A. BIEGEL, so konnte er zwischen Ursa Maior und dem Zenit das Nilpferd im Bootes erblicken, auf ein mit Coma-Sternchen geschmücktes Messer gestützt; den Horus An in Coma und Leo Minor — den halbwegs zum Äquator verschobenen Wender der Polgegend; und anderer Wunder mehr, auf deren Schilderung ich hier verzichte. Sollte nun dieser auf dem Rücken liegende Ägypter auf den Gedanken kommen, aufzustehen und sich die nie untergehenden Gestirne des Nordens anzusehen, so würde er das Siebengestirn (Schenkel, Stier-Ovoid, Stier) in oberer Kulmination nach links dahingleitend erblicken, darunter die Lanze des Wenders, die Gegend des Pols durchstechend, noch weiter nach unten, rechts vom Nordpunkt des Horizonts, eine auf der Spitze stehende Sterngruppe (Pflock, Messer, steifes Krokodilchen, Gefäss usw.) und weiter rechts vom Meridian das aufrecht einherschreitende Nilpferd. Vgl. Abb. 2 und 3.

Damit wäre der erste Teil der BIEGELschen Dissertation erledigt; auf den zweiten Teil, die « Mythologische Deutung », kann ich nicht eingehen.

189 *Harvard Library* A. POGO.
Cambridge, Mass.

The Whaling Museums of New Bedford and Nantucket

A few years ago I devoted a note in this journal (vol. 8, 492-96), to the Musée Pyrénéen of Lourdes and took advantage of this to descant upon the importance of local or regional museums. There ought to be in the center of every district not only a little museum relative to the natural history of that district, but also a historical museum. In a way the second museum is even more important than the former, because historical objects are often unique or rare, and when they are lost they are lost forever. If the objects of historical interest were still too few in number, they might be temporarily kept in a room or in a cupboard of the town hall or of any other public building. Sooner or later a museum must be established; this is just as necessary for the spiritual health of the community as the school or the library. It affords a pleasant opportunity for young and old alike to remember the deeds of their predecessors and to derive some inspiration from them. I am glad to say that there are quite a few such museums in Massachusetts, but the majority of the exhibits refer to the Revolution or to other wars, or to the manners and customs of earlier days, to their arts rather than to their industries. To be sure the historian of science and technology may find some items of interest in almost every collection of that kind, but not enough to justify a long journey.

The museums of which I am going to speak presently are of a different kind. They are almost exclusively dedicated to the commemoration of an industry now extinct (at least in its original form)—whaling—of which New Bedford and Nantucket were a century ago the most important centers in the world. A visit to one of these museums, or preferably to both (1) will

(1) This can easily be managed. There is a regular steamboat service between

give any intelligent person a very good idea of whaling in general and of the subsidiary industries; he will then be ready to read a treatise on the subject with sufficient appreciation of the technical details involved. These two museums are so good that a historian of science or technology finding himself, say, in New York or in Boston, should try by all means to visit them.

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The New Bedford Museum is the oldest as well as the largest. It was organized by the Old Dartmouth (1a) Historical Society incorporated in 1903; the main exhibits are located in the Bourne Building, a fine Georgian hall dedicated in 1916 to the memory of one of the most successful whaling merchants of New Bedford, JONATHAN BOURNE (1811-89).

The central object in that hall, is a half-sized model of Mr. BOURNE's favorite ship, the Lagoda. The Lagoda—so named by mistake after the Russian lake Ladoga !—was built at Scituate, Mass., in 1826, and condemned at Yokohama in 1890. Her capacity was 352 net tons. Her original rig was that of a ship, but she was altered into a bark in 1860. Most whaling vessels were barks. (2) The half-sized model is complete in every detail and « ready to sail on a ' greasy ' voyage, if half-sized seamen could be found to man her ». The length of that model on the water line is 54 ft. 9, the extreme length from the tip of the flying jib-boom to the tip of the spanker boom is 82 ft. 6, and the height from the water line to the main royal truck is 50 ft. Visitors are allowed to board it, and to examine every object on the deck and below. The good bark Lagoda was frequently mentioned by RICHARD HENRY DANA in his « Two years before the mast » (1840).

New Bedford and Nantucket Island; the distance is 54 miles and the voyage lasts a little less than five hours in good weather. From Boston to New Bedford it takes about one hour and a half in the train; from New York to New Bedford is an overnight voyage by steamboat.

(1a) From 1652 to 1787 New Bedford was a part of the town of Dartmouth.

(2) A bark is a three-masted vessel fitted with square sails on her fore and mainmasts, and with fore-and-aft, or schooner rig sails, on her mizzen-mast. The same name was sometimes given to a four-masted vessel fore-and-aft rigged on the spanker mast.

The other exhibits, though less spectacular, are at least equally interesting. There is a full sized whale-boat which saw actual service, and was even stove by a whale and subsequently repaired. The equipment of it is complete and in readiness for the chase. It could be propelled by the sprit-sail or by five sets of oars of *different* lengths. It contains harpoons, lances, a lance-straightener, knives, hatchets, loggerheads, tubs of line, etc. That equipment—as well as the tools used aboard the bark—was the fruit of centuries of experience ; it is exceedingly ingenious in its simplicity. It can be studied with advantage in the Bourne Building, for considerable collections of harpoons, darting guns, lances and other implements are arranged around the walls. Moreover old shops catering to the whaling industry have been carefully reconstructed in the gallery, e.g., a sail loft, a cooper's shop, a shipsmith's shop, a rigging loft and a whale boat shop. There are also many « whaliana » in an older building, the Rogers Building, adjacent to the Bourne Building. One may find there many more models of ships, chiefly an impressive model of a Spanish man-of-war (c. 1780), more than 13 ft. long, also abundant examples of « scrimshaw » (3).

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The treasures kept in the Rogers and Bourne Buildings do not exhaust the whaling curiosities of New Bedford. Not to speak of the many objects jealously preserved in private houses, two very important items must still be mentioned.

To begin with, across the street from the whaling museum stands the Seamen's Bethel immortalized in HERMAN MELVILLE's « Moby Dick ». That astounding novel is not simply one of the classics of American (and English) literature, but the epic

(3) « Throughout the Pacific, and also in Nantucket, and New Bedford, and Sag Harbor, you will come across lively sketches of whales and whaling scenes graven by the fishermen themselves on Sperm Whale-teeth or ladies' busks wrought out of the Right Whale bone, and other like skrimshander articles, as the whalemen call the numerous little ingenious contrivances they elaborately carve out of the rough material in their hours of ocean leisure. Some of them have little boxes of dentistical-looking implements, especially intended for the skrimshandering business. But in general they toil with their jackknives alone; and with that almost omnipotent tool of the sailor, they will turn you out anything you please in the way of a mariner's fancy. » (*Moby Dick*, chapter 57).

of whaling. HERMAN MELVILLE visited the Seamen's Bethel in January 1841, before sailing on the whaling ship Acushnet of Fair Haven. The original of his « Father Mapple » (in *Moby Dick*) was the Rev. ENOCH MUDGE (Lynn 1776—Lynn 1850). (4)

In the second place, an original whaling ship, the Charles W. Morgan, is enshrined on Col. Green's estate at Round Hills, South Dartmouth. She was floated ashore in 1925 and a cofferdam was built around her; the space surrounding her was then emptied of water and filled with sand to the waterline. From a distance she seems to be tied to the wharf, but in reality her keel is imbedded in sand to insure its preservation. The good ship has been entirely refitted down to the smallest details. She forms thus in herself a complete and ideal whaling museum. The Charles W. Morgan was built in New Bedford in 1841, and registered 298 tons net. Her measurements are 105 feet, 6 inches long, 27 feet, 7 inches beam and 17 feet, 6 inches deep. Her original rig, that of a ship, was changed to a bark in 1867, and changed back to a ship when refitted at Round Hills. She sailed ship-rigged for 26 years, and bark-rigged for 55 years. G. WARREN HIRSHSON : *The whale ship Charles W. Morgan* (illustrated pamphlet, New Bedford 1926). (5)

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Let us now sail to the other museum, a most delightful voyage across Buzzards Bay to Woods Hole, then across Vineyard Sound to Marthas Vineyard, finally across Nantucket Sound to the old town of Nantucket. As a whaling center Nantucket was second only to New Bedford, and I am not certain whether the old Nantucketters would even grant that much. To be sure by the middle of the nineteenth century, New Bedford had become the most important whaling town, but that was a relatively late develop-

(4) One hundredth anniversary of the New Bedford Port Society, 1830-1930. Illustrated booklet reprinted from the *Morning Mercury*. Reynolds Printing, New Bedford, Mass., 1930.

(5) For the sake of European readers I may add that Col. E. H. R. GREEN is the son of HETTY GREEN, one of the most remarkable characters in American finance. Her biography has recently been published by BOYDEN SPARKES and SAMUEL TAYLOR MOORE : *Hetty Green, a woman who loved money* (Garden City, N. Y., 1930).

ment. Whaling did not begin in that place before the middle of the eighteenth century and by that time it was almost a century old in Nantucket. Leaving out of account the occasional exploitation of drift whales cast ashore by the sea, American whaling was originated either by settlers of the eastern end of Long Island (c. 1650-70) or by the inhabitants of Nantucket. The latter received their first hints from the aboriginal Indians. Some thirty years after the first settlement (1659), the catching of whales had already commenced, but for a while the islanders were satisfied to pursue the whales seen in the vicinity, which after capture were towed ashore to the triworks on the beach where the oil was extracted, placed in barrels and carted to the city. The first Sperm Whale was captured in 1712 by a Nantucket whaleman who had been blown out to sea, and the beginning of operations on a larger scale is traditionally ascribed to that accident. During the early phase of the industry Nantucket was undoubtedly the leader and by far. As the prosperity of whaling increased, competition multiplied and ships were outfitted in many New England harbors. Before the Revolution American whaling had already become very important, but its era of greatest prosperity began after the peace of 1783, and after many vicissitudes it was already over before 1860.

We may recall that Nantucket whalers were among the first to obtain an accurate and practical knowledge of the Gulf Stream. Indeed it is from them that BENJAMIN FRANKLIN obtained most of his information about it—which enabled him to draw and publish a chart of it—, especially from a « captain FOLGER » (6) probably TIMOTHY FOLGER, his kinsman. That TIMOTHY was a direct descendant of PETER FOLGER, whose daughter ABIAH (1667-1752) married JOSIAH FRANKLIN and gave birth to BENJAMIN. We may also recall that in 1773 three whale ships belonging to the Rotch firm of Nantucket, the Dartmouth, the Beaver, and the Bedford, were chartered by the East India Company to carry tea from London to Boston. Upon their arrival they were the scene of the « Boston Tea Party ». Moreover the Bedford was the first ship to fly the American flag in a British port, and

(6) The Works of BENJAMIN FRANKLIN (vol. 3, 353, 364, Philadelphia, 1809). A. STARBUCK : The history of Nantucket (Boston, 374, 1924.)

the Beaver was the first (American) whaleship to round Cape Horn (c. 1791).

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The Museum organized by the Nantucket Historical Association, though smaller than the New Bedford one, is not a bit less interesting. To compare the merits of both, to find out which has the finest set of harpoons, the richest collection of whaling log books, etc., would take too long. It is probable that such a comparison would reveal the superiority of each museum in a certain number of particulars. In fact the two museums complete one another beautifully, and I cannot but recommend once more to all visitors of either to pay a visit to the other as well.

The Nantucket Museum is quite a novelty for it was only opened this summer (1930), but I was already familiar with many of the exhibits for having seen them in the Historical Museum on Fair Street. However, the new Whaling Museum is more than an offshoot from the older Museum. Both Museums were organized by the Nantucket Historical Association, incorporated in 1894 (that is, nine years earlier than the Old Dartmouth Society). The first Museum was established in 1904. The new Museum was arranged with considerable taste by the son of one of the most successful whaling masters, Capt. CHARLES GRANT (1814-1906).

It would be difficult to improve upon the disposition of the Bourne Building; but New Bedforders would be, I believe, the first to admit that the arrangement of the Rogers Building is very unsatisfactory. The Nantucket arrangement is on the whole more restful. It would be interesting to compare the New Bedford and Nantucket exhibitions more thoroughly, and the more so because their program is of necessity almost identical. In both Museums there are large collections of quartants, sextants, and other nautical instruments. In both do we find marine charts, but in Nantucket a little room is especially devoted to them. In both do we find a gallery of portraits of famous captains, but here again Nantucket is scoring, for her portraits are put together in a room and are shown to better advantage. Sea captains were sometimes represented holding their spy glass, but in Nan-

tucket they have had the touching idea, whenever a captain's glass has been preserved, to exhibit it above his own portrait ! Such pleasing details increase the historical and sentimental interest of the exhibits and the visitor's delight.

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We cannot leave Nantucket without recalling for the benefit of historians of astronomy that it was the birthplace of MARIA MITCHELL (1818-1889), who was the first professor of astronomy at Vassar College, and one of the most distinguished American astronomers of the last century. (7) A memorial observatory has been established in the yard of the house in which she was born in Vestal Street. There is also a scientific library in a building on the opposite side of Vestal Street, and a little museum of natural history in the house itself. It is probable that Nantucket can boast more museums than any American city of its size, and than most American cities of any size !

Finally, the whaling collections of New Bedford and Massachusetts are not the only public collections of their kind in Massachusetts. There is also a very rich one, which I have had thus far no opportunity of studying in the Peabody Museum of Salem. See the catalogue of an exhibition dealing with « The whaling industry » published by that Museum in 1908.

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My information was largely derived from the exhibits which it was my privilege to examine. A description of the New Bedford Museum was published by the Old Dartmouth Historical Society : *Whaling exhibits* (48 p., New Bedford, 1924; reprinted in 1926, 1930). There is not yet a guide to the Nantucket Museum, but a good many books have been devoted to Nantucket and her whalers. The catalogue of the Peabody Museum whaling exhibition of 1908 has already been mentioned.

For Nantucket, see chiefly SAINT JOHN DE CRÈVECŒUR (1735-

(7) PHEBE MITCHELL KENDALL : *Maria Mitchell. Life, letters and journal* (300 p., Boston, 1896).

1813) : *Letters from an American farmer* (London, 1782) and ALEXANDER STARBUCK : *The history of Nantucket* (Boston, 1924).

For New Bedford, LEONARD BOLLES ELLIS : *History of New Bedford and its vicinity*, 1602-1892 (Syracuse, N. Y., 1892).

SAMUEL ELIOT MORISON : *The maritime history of Massachusetts*, 1783-1860 (420 p., ill., Boston, 1921).

Whaling.—The literature on whaling is equally bewildering by its size and its variety. Some idea of it may be obtained by consulting GEO. H. TRIPP : *A collection of books, pamphlets, log-books, pictures*, etc. *illustrating whales and the whale fishery contained in the Free Public Library* (2d. ed., 24 p., 5 pl., New Bedford, 1920). There are also good collections of books on whaling in the Nantucket and Salem museums and in the Daniel B. Fearing Library which is now a part of the Harvard Library. Perhaps the best general introduction to the subject is JAMES TRAVIS JENKINS : *A history of the whale fisheries*. From the Basque fisheries of the tenth century to the hunting of the finner whale at the present date (336 p.,with illustrations and bibliography, London, WITHERBY, 1921 ; *Isis*, 4, 646).

American whaling.—WILLIAM MORRIS DAVIS : *Nimrod of the sea, or The American whaleman* (420 p., New York, 1874 ; reprinted Boston, 1926). ALEXANDER STARBUCK : *History of the American whale fishery from its earliest inception* (768 p., 6 pl., Waltham, Mass., 1878). WILLIAM HUSSEY MACY : *There she blows !* The whales we caught and how we did it (327 p., ill., Boston, 1893). WALTER SHELDON TOWER : *A history of the American whale fishery* (155 p., University of Pennsylvania, Philadelphia, 1907). JOHN RANDOLPH SPEARS : *The story of the New England whalers* (428 p., 9 pl., New York, 1908). GEORGE FRANCIS DOW : *Whaleships and whaling*. Pictorial history of whaling during three centuries. With an account of the whale fishery in colonial New England (51 p., 440 pl., Salem, 1925). EDWARD KEBLE CHATTERTON : *Whalers and whaling, the story of the whaling ship up to the present day* (Philadelphia, 1926). JOSEPH T. HIGGINS : *The whale ship book, the distinguishing details of old time whale ships with a complete description of a typical whaler and working plans of the famous Alice Mandell* (36 p., pl., New York, 1927). ELMO PAUL HOHMAN : *The American whaleman, a study of life and labor in the whaling industry* (370 p., New York, 1928). CLIFFORD

WARREN ASHLEY : *The Yankee whaler* (404 p., ill., Boston, 1926); *Whaleships from New Bedford* (60 pl. from his drawings, Boston, 1929).

And above all HERMAN MELVILLE's immortal *Moby Dick* (1851) !

Nantucket, Massachusetts GEORGE SARTON.
September 14, 1930.

Notes and Correspondence

I. The History of Science.

The History of Science Society Council Record (Meeting December 30, 1930).—The Council met at Western Reserve University, Room 27, Main Building, at 4:15 P.M., with Vice-president WILLIAM H. WELCH in the chair.

Present: The Vice-president, Drs. BRETT, KLEBS, RUFUS, SANFORD, SIMONS, WALCOTT and the Secretaries BRASCH and MAYER. Dr. CREW arrived later. Dr. HARVEY CUSHING was present as a guest.

Minutes of last meeting were read and approved.

Election of new officers and Council members. Ballots were counted and the following declared elected : President, Dr. WILLIAM H. WELCH; Vice-presidents : Dr. BERTHOLD LAUFER, Dr. J. PLAYFAIR MCMURRICH; Members of the Council to serve until December 1933; Dr. HENRY CREW, Dr. ARNOLD C. KLEBS, Dr. VERA SANFORD, Dr. STEPHEN D'IRSAY, Dr. CHAUNCEY D. LEAKE.

Report of Treasurer and Corresponding Secretary was read and approved.

Report of Editor of Isis. In the absence of the Editor, the report was read by the Corresponding Secretary. It was approved by the Council with appreciation of the Editor's devoted services, after which it was

Voted that the incoming president be empowered to enlarge the Endowment Committee and that the matter of securing an endowment for *Isis* be referred to it, with the suggestion by the Chairman that a trusteeship be set up for the administration of any fund secured for *Isis*.

Reconstructed Articles of Agreement between the History of Science Society and the Editor of *Isis*, previously approved by the Executive Committee, were read and approved by the Council. It was authorized that a copy be sent to the Editor of *Isis* for publication.

Publications Committee. Dr. BRETT reported that of the $ 7500 Book Fund, $ 500 had been paid to the Columbia University Press for the publication of Miss ANNA CAMPBELL's book on « The Effect of the Black Death on the Intellectual Life of Europe ». The question was then presented of financing a source book on the astronomer HALLEY to the amount of $ 2000, compiled by EUGENE T. MACPIKE. It was

Voted to give the Society's endorsement to the publication of the HALLEY source book, « Correspondence and papers of Dr. EDMOND HALLEY, F.R.S. » by Mr. MACPIKE, granted out of the Publication Fund, provided the endorsement can be secured of a member of the Royal Society, such as EDDINGTON, RUTHERFORD or JEANS.

George Washington Bi-centennial Celebration. The Corresponding Secretary presented this project, after which it was

Voted to refer the matter with power to the incoming president and the two Secretaries. Subsequently the President and the Recording Secretary agreed to endorse the resolutions presented to the American Association for the Advancement of Science, covering the same subject. The Corresponding Secretary concurred with this action.

Voted to authorize the President to appoint a Committee on Membership, and later in the year a Program Committee and a Nominating Committee.

Alternate to the American Council of Learned Societies. Dr. CREW elected.

Treasurer and Corresponding Secretary for 1931. Mr. BRASCH reelected.

Recording Secretary for 1931. Dr. MAYER reelected.

The meeting was adjourned at 5:30 P.M.

JOSEPH MAYER,
Recording Secretary.

The History of Science Society and its relationship with Isis. — *Isis* was founded in Wondelgem, near Ghent, Belgium, in 1912. The original program (the article entitled L'histoire de la science, reprinted at the beginning of vol. 1) was published at the end of that year; the first number of *Isis* appeared in March 1913.

The History of Science Society was founded in Boston, Massachusetts, on January 12th 1924, upon the initiative of Professor DAVID EUGENE SMITH, supported by a national committee of American scholars and scientists. A list of it together with an account of the foundation was printed in *Isis* (vol. 6, 4-8, 1924).

The following « Articles of agreement between the History of Science Society and the Editor of *Isis* » are now printed as a matter of record at the request of the Council of the Society.

Article I. The following agreement complements, completes and replaces the tentative verbal agreement entered into at the Foundation Meeting of the Society held at the house of the American Academy of Arts and Sciences in Boston on January 12th, 1924.

Article II. The dues of the History of Science Society shall be $ 5.00 per annum.

Article III. The journal *Isis* shall be the official organ of the Society.

Article IV. The editor of *Isis* shall publish each year in this journal a minimum of six hundred octavo pages.

Article V. The Society shall pay to the editor of *Isis* $ 4.00 for each $ 5.00 received in annual dues from its members.

Article VI. In the case of a life membership fee paid to the Treasurer, he shall pay to the editor of *Isis* each year during the number of years for which the fee was computed, eighty (80) per cent of the annual amount on which the fee was also computed.

Article VII. The Treasurer of the Society shall send to the editor of *Isis* in each of the months, October to May inclusive, a check covering eighty (80) per cent of all the annual dues received by him since the previous payment to the editor.

Article VIII. It is understood that in the event of the Society's publishing another journal, the name of this journal shall not be *Isis*.

Article IX. It is understood that in each number of *Isis* the editor shall publish appropriate information concerning the conditions of membership in the Society, a list of its officers and such other news of its meetings and proceedings as may seem to him desirable.

Article X. This agreement may be changed only with the consent of both parties.

Second International Congress of the History of Science and Technology, London, June 29th to July 3rd, 1931. Organised by *Le Comité International d'Histoire des Sciences*, (Permanent Secretary : ALDO MIELI). With the Co-operation of *Le Comité International des Sciences historiques*, *The Newcomen Society for the Study of the History of Engineering and Technology*, *The History of Science Society*.

President :

* CHARLES SINGER

Hon. Treasurer :

* SIR WILLIAM H. BRAGG, K.B.E., F.R.S., Director, Royal Institution of Great Britain

Council in Great Britain :

PROF. E. N. DA C. ANDRADE, University of London
DR. AGNES ARBER, Cambridge
DR. O. L. BRADY, University of London
MAJOR A. G. CHURCH, D.S.O., M.C., M. P.
PROF. F. J. COLE, F.R.S., University of Reading
The RT. HON. the EARL OF CRAWFORD AND BALCARRES, K.T., F.R.S.
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PROF. MAJOR GREENWOOD, F.R.S., London School of Hygiene and Tropical Medicine
* PROF. C. H. DESCH, F.R.S., University of Sheffield
* SIR WALTER M. FLETCHER, K.B.E., C.B., F.R.S., Secretary, Medical Research Council
* SIR RICHARD GREGORY, Editor of *Nature*
DR. R. T. GUNTHER, The Old Ashmolean, Oxford
SIR ROBERT A. HADFIELD, Bart., F.R.S.
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PROF. A. HEATH, National University of Wales
SIR THOMAS L. HEATH, K.C.B., K.C.V.O., F.R.S.
PROF. LEONARD HOGBEN, London School of Economics
* DR. E. J. HOLMYARD, Clifton College
PROF. JULIAN HUXLEY, London
SIR JAMES H. JEANS, Late Secretary, Royal Society
RHYS JENKINS, ESQ., Past President, Newcomen Society
PROF. JAMES JOHNSTONE, University of Liverpool
SIR ARTHUR KEITH, F.R.S., Royal College of Surgeons
* SIR FREDERICK G. KENYON, G.B.E., K.C.B., F.B.A., Director, British Museum
THE MOST HON. THE MARQUESS OF LANSDOWNE, D.S.O.
* COL. SIR HENRY G. LYONS, C.B., F.R.S., Director, Science Museum
PROF. E. W. MACBRIDE, F.R.S., Imperial College of Science
PROF. F. S. MARVIN, University of Cairo
DR. A. MAWER, F.B.A., Provost, University College, London
THE RT. HON. LORD MOYNIHAN, K.C.M.G., C.B., President, Royal College of Surgeons
PROF. J. L. MYRES, O.B.E., F.B.A., Oxford
JOSEPH NEEDHAM, ESQ., Gonville and Caius College, Cambridge
SIR GEORGE NEWMAN, K.C.B., Ministry of Health
PROF. SIR T. PERCY NUNN, London Day Training College
* G. PARSLOE, ESQ., Secretary, Institute of Historical Research
PROF. J. R. PARTINGTON, M.B.E., University of London
L. ST. L. PENDRED, ESQ., President, Institution of Mechanical Engineers
PROF. A. F. POLLARD, F.B.A., Director, Institute of Historical Research
LT.-COL. SIR D'ARCY POWER, K.B.E.
PROF. JOHN READ, University of St. Andrews
PROF. SIR HUMPHRY D. ROLLESTON, BART., G.C.V.O., K.C.B., Cambridge
DR. E. S. RUSSELL, O.B.E., Board of Agriculture and Fisheries

SIR E. JOHN RUSSELL, O.B.E., F.R.S., Rothamsted Agricultural Station
SIR ERNEST RUTHERFORD, O.M., Past President, Royal Society
PROF. R. A. SAMPSON, F.R.S., Astronomer Royal for Scotland
SIR W. NAPIER SHAW, F.R.S., Late Director, Meteorological Office
* MRS. DOROTHEA WALEY SINGER
PROF. G. ELLIOT SMITH, F.R.S., University of London
ROBERT STEELE, ESQ., London
PROF. D'ARCY THOMPSON, C.B., F.R.S., University of St. Andrews
H. T. TIZARD, F.R.S., Rector, Imperial College of Science
PROF. A. WOLF, University of London

Vice-President, Comité International d'Histoire des Sciences:
DR. GEORGE SARTON, Harvard University

Treasurer, Comité International d'Histoire des Sciences:
PROF. HENRY E. SIGERIST, University of Leipzig

Hon. Secretary:
* H. W. DICKINSON, ESQ.

Assistant Hon. Secretary;
* WALTER ADAMS, ESQ.

All communications to be addressed to the Hon. Sec., The Science Museum, South Kensington, London, S.W. 7.

Those with an asterisk form the Executive Committee.

The Second International Congress of the History of Science and Technology will take place in London from Monday, June 29th to Friday, July 3rd, 1931, with the Science Museum, South Kensington as its headquarters. Dr. CHARLES SINGER will be the President.

The Congress originated with the *Comité International d'Histoire des Sciences* which was founded at Oslo on August 17th, 1928. This body meets annually in Paris and organises every three years a Congress in which persons interested in the History of Science and Technology are invited to take part. For the coming Congress the Comité has been fortunate in enlisting the co-operation of its parent body, the *Comité International des Sciences Historiques*, together with that of two other international Societies, the *History of Science Society*, Washington D.C., and the *Newcomen Society for the Study of the History of Engineering and Technology*, London. The aim of the Congress is to provide opportunity for intercourse and exchange of thought between all those who are interested in the various departments of the History of Science and Technology.

The programme will include morning sessions for the presentation and discussion of communications on the history of science and technology, afternoon visits to Kew Gardens, Down House, Greenwich, Barbers Hall, the Royal College of Physicians, the British Museum, the Natural

History Museum and the National Portrait Gallery, excursions to Oxford and Cambridge and social engagements in the evenings.

Further particulars can be obtained from the Honorary Secretary of the Congress, H. W. DICKINSON, The Science Museum, South Kensington, London, S.W. 7.

Section d'Histoire des Sciences et de la Médecine au Congrès International des Sciences Historiques (Varsovie, 1933). — Le VI[e] Congrès International des Sciences Historiques, tenu à Oslo en 1928, décida que le prochain Congrès aurait lieu à Varsovie en 1933. Or, le Comité International des Sciences Historiques, dans son assemblée tenue à Londres le 2 mai 1930, a confié officiellement au Comité International d'Histoire des Sciences le soin d'organiser, au Congrès de Varsovie, la Section d'Histoire des Sciences, qui doit comprendre aussi l'histoire de la médecine. C'est ainsi que dans sa réunion à Paris du 22 au 24 mai 1930 le Comité International d'Histoire des Sciences a nommé une Commission Organisatrice de la dite Section.

Ont été élus les membres suivants de la Commission : MM. S. DICKSTEIN, Varsovie, président, V. L. BOLOGA, Cluj, P. DIEPGEN, Berlin, A. MIELI, Paris, CH. SINGER, Londres, Q. VETTER, Prague, A. BIRKENMAJER, Cracovie, secrétaire, sous réserve de droit de cooptation.

On a fixé, en même temps, certaines directives pour le programme scientifique de la Section projetée. On a choisi comme sujet principal de la discussion *L'histoire des sciences au XVI[e] siècle*, se composant de communications particulières sur l'histoire des mathématiques, de l'astronomie, de la biologie, de la médecine, etc., à l'époque envisagée. Deux jours seront consacrés à ce thème. Un troisième jour sera consacré à l'histoire des sciences en Pologne, en Hongrie, en Roumanie et en Tchécoslovaquie. Il sera rempli par 4 communications synthétiques dont chacune s'occupera de l'histoire des sciences dans un des pays susnommés, depuis le moyen âge jusqu'à nos jours. Les deux autres jours seront destinés aux thèmes libres.

Se basant sur ces directives, le président de la Commission, M. S. DICKSTEIN, a convoqué deux réunions d'historiens polonais des sciences et de la médecine — 9 juin et 30 novembre 1930, — pendant lesquelles la Commission a jugé convenable de s'adjoindre les membres suivants : MM. W. BUGIEL, Paris, T. VON GYÖRY, Budapest, W. SZUMOWSKI, Cracovie, J. TALKO-HRYNCEWICZ, Cracovie, J. TRICOT-ROYER, Anvers, A. WRZOSEK, Poznań, L. ZEMBRZUSKI, Varsovie, W. ZIEMBICKI, Léopol. On a discuté aussi : le programme détaillé des travaux de la Section, l'organisation, pendant le Congrès de Varsovie, d'une exposition des objets les plus remarquables illustrant l'histoire des sciences et de la

médecine en Pologne, en Hongrie, en Roumanie et en Tchécoslovaquie (manuscrits, imprimés, portraits, gravures, instruments, etc.), ainsi que les publications à éditer à l'occasion du Congrès.

Deux membres de la Commission, MM. W. SZUMOWSKI et L. ZEMBRZUSKI, ont pris part, comme délégués de la Pologne, à la séance du Comité Permanent de la Société Internationale d'Histoire de la Médecine, tenue à Rome le 26 septembre 1930, à l'occasion du VIII[e] Congrès International d'Histoire de la Médecine. A la suite de leur rapport, le Comité Permanent prit note du fait qu'au Congrès de Varsovie l'histoire de la médecine formera avec l'histoire des sciences une section commune.

En portant à leur connaissance ces travaux préparatoires, la Commission Organisatrice invite dès maintenant tous les historiens des sciences et de la médecine à prendre part au Congrès projeté, et notamment à annoncer les communications dont les sujets trouveraient place dans les limites du programme esquissé plus haut. Jusqu'à présent, les communications suivantes ont été annoncées à la Commission :

1. P. DIEPGEN (Berlin): Der Geist der Medizin des XVI. Jahrhunderts.

2. A. MIELI (Paris) : Rapport concernant la publication de tables chronologiques de la science au XVI[e] siècle.

3. A. BIRKENMAJER (Cracovie) : La structure primitive du système héliocentrique imaginé par NICOLAS COPERNIC.

4. A. BIRKENMAJER (Cracovie) : L'édition complète des Œuvres de NICOLAS COPERNIC.

5. E. ZINNER (Bamberg) : Ueber NIKOLAUS KOPPERNIK (le sujet sera précisé plus tard).

6. A. MIELI (Paris) : Chimica ed alchimia, mineralogia e metallurgia nel Cinquecento in Italia.

7. F. M. FELDHAUS (Berlin) : Die Stellung und Bedeutung der Krakauer Bilderhandschrift von BALTHASAR BEHEM über das Handwerk und die Technik im Jahre 1505.

8. L. ZEMBRZUSKI (Varsovie) : L'enseignement des sciences naturelles et de la médecine à l'Académie de Zamosc.

9. W. SZUMOWSKI (Cracovie) : École polonaise médico-philosophique.

On est prié d'adresser l'annonce des communications ainsi que toute la correspondance concernant le Congrès aux mains d'un des soussignés.

A. BIRKENMAJER, secrétaire
Cracovie, Garbarska 7 A.

S. DICKSTEIN, président
Varsovie, Marszalkowska 117.

Varsovie-Cracovie, au mois de décembre 1930.

Krishnakumari Ganesh Prasad prize and medal for research in the history of mathematics in India before 1600 A.D. — Dr. GANESH PRASAD, Hardinge Professor of Higher Mathematics in

the Calcutta University and President of the Calcutta Mathematical Society has handed over to the Society 3 ½ % G.P. Notes of the face value of Rs. 1,400 for the creation of an endowment for the purpose of awarding a prize and medal in memory of his daughter. Rules for the award of the medal and prize have been laid down by the Calcutta Mathematical Society and published in its Bulletin.

Forty fifth Annual Meeting of the American Historical Association. — *Boston, Dec. 29 to 31, 1930.*

One of the many meetings and conferences was of especial interest to members of the History of Science Society, namely, the one on Medical Science, held at the Fogg Art Museum in Cambridge on Dec. 30, 1930 at 4.30 P.M. The main speaker was LYNN THORNDIKE who defended his project of a Corpus of medieval scientific literature in Latin published in *Isis* (vol. 14, 368-84). THORNDIKE's lecture was followed by a discussion led by the Chairman, Prof. DANA CARLETON MUNRO of Princeton, in which took part Dr. GEORGE SARTON, Prof. JAMES WESTFALL THOMPSON of Chicago, Dr. JAMES J. WALSH of New York, and others.

Baltimore, Maryland. —A movement is on foot to raise an endowment for a professorship of physiology to be named after JOHN C. HEMMETER, the distinguished physician and historian of medicine. Dr. HEMMETER was professor of physiology in the University of Maryland from 1903 to 1922.

Washington, D. C. — Among the new courses offered in the School of Economics and Government of National University, Washington, D.C. for the current year is a full course in the History of Science extending throughout the three semesters of the school year. The course is under the direction of Dr. JAMES F. COUCH, Professor of Science and will include in addition to the formal instruction a number of lectures by various specialists on the modern developments in their own fields. A large enrollment in the course indicates that it is one of the more popular subjects offered by the faculty.

II. Personalia.

Nyoden Ôtsuki, whose *Yôgaku nempyô* (chronological table of occidental learning in Japan) was reviewed in *Isis* (vol. 10, 82-83) by Professor YOSHIO MIKAMI, died on Jan. 12, 1931, at the advanced age of 86.

G. S.

Reviews

Gustav Junge and **William Thomson.** —*The commentary of Pappus on book X of Euclid's Elements.* Arabic text and translation by WILLIAM THOMSON with introductory remarks, notes, and a glossary of technical terms by GUSTAV JUNGE and WILLIAM THOMSON. 294 p. (*Harvard Semitic series*, vol. 8) Cambridge, Harvard University Press, 1930.

A new edition of the commentary of PAPPUS on the tenth book of EUCLID's Elements has since long been a desideratum of history of mathematics. By preparing this edition the Professors JUNGE and THOMSON rendered a distinct service to all students of Greek and Arabian mathematics.

The title is somewhat misleading regarding the division of work between the two authors. JUNGE contributed a German introduction (pp. 11-37), where some literary aspects and the mathematical content are discussed at length. It contains a short and masterly sketch of the theory and history of the irrational from PLATO to APOLLONIUS. For the rest of the work THOMSON alone is responsible. It contains an introduction discussing the items : (1) Description of the Ms. (2) The sources of PAPPUS's conception of rational quantities. (3) Collation of the Arabic text with the Greek scholia. (4) Translation and text. Then follow the English translation with notes, an Appendix concerning the term *dynamis*, an Index, the Arabic text with notes, and a very useful Arabic glossary of technical terms. His was not an easy task, as all scholars familiar with this kind of work will realize. Great credit is due to him for devoting years of hard work and conscientious investigation to bring it to a fairly good solution.

The commentary of PAPPUS is preserved only in the Arabic translation of ABŪ 'UTHMĀN AL-DIMISHQĪ. AL-DIMISHQĪ flourished in the first quarter of the tenth century at Bagdād under the Caliph AL-MUQTADIR (908-932). He was famous as a physician, mathematician and as a translator of many works from the Greek. His translation of the commentary of PAPPUS is to be found in MS. 2457 of the Bibliothèque Nationale in Paris. Excerpts of this commentary with a French translation

have been published by WOEPCKE in his *Essai d'une restitution de travaux perdus d'Apollonius sur les quantités irrationelles*, Paris, 1856. WOEPCKE, however, was mistaken in ascribing the commentary to the astronomer VETTIUS VALENS of the time of PTOLEMY. The investigations of FLUEGEL (1), HEIBERG (2), SUTER (3), and THOMSON adduce abundant proof for the authorship of PAPPUS. Though CANTOR (4) still adheres to WOEPCKE's opinion, the authorship of PAPPUS may be regarded as a well established fact.

A somewhat curious bibliographical fact is related by Professor JUNGE. In 1855 the whole Arabic text of the commentary was printed by WOEPCKE in the house of FIRMIN-DIDOT, Publishers, Paris. The book appeared in deep secrecy. No name of the author was mentioned, no date or place of printing, and the public hardly took notice of it. Of the whole edition only a few copies remained. One is still extant in the library of the Academy of Sciences in Berlin, and a photograph copy of it was prepared for the present edition. A second copy was in the library of Professor HEIBERG, Kopenhagen, and a third copy is known to have been used by SUTER for the German translation, but JUNGE was unable to locate it.

WOEPCKE, himself, made no mention of this edition in his *Essai d'une restitution*, 1856, but the archives of the Berlin Academy have the record of a payment to WOEPCKE of 300 *Taler* as a contribution to the expenses of the publication. The probability is that the edition of 1855 was prepared in a few copies and for private circulation only. As has been stated, a German translation of the commentary was prepared by SUTER from the anonymous copy. It was published in 1922 after SUTER's death.

The tenth book of EUCLID's Elements deals with the theory of the irrationals and incommensurables, and so does PAPPUS' commentary. The discovery of the incommensurability of the diagonal and the side of a square, and the origins of the science in general are assigned to the Pythagorean school. The first written traces of the theory are found in PLATO's works. THEAETETUS « divided the more generally known irrational lines according to the different means, assigning the medial line to geometry, the binomial to arithmetic, and the apotome to harmony, as is stated by EUDEMUS, the Peripatetic » (5) Let us assume

(1) *Fihrist*, II, p. 124.

(2) *Literargeschichtliche Studien über Euklid*, 1882, pp. 162-64.

(3) In his German translation of the commentary in *Abhandlungen zur Geschichte der Naturwissenschaften und der Medizin*, Heft IV, Erlangen, 1922, pp. 9-10.

(4) *Geschichte der Mathematik*, I^{4}, pp. 348, 425.

(5) Cf. I, § 1 of the text, p. 63.

that 1 and $\sqrt{2}$ are the side and diagonal of a square. (It must be borne in mind that in Greek theory $\sqrt{2}$ is a rational line, being commensurable in its square, *dynamei*, *potentia*, with the square of the side.) Then $\sqrt[4]{2}$, the geometric means, is the medial line; $\frac{1+\sqrt{2}}{2}$, the arithmetic means, is the binom; and finally the harmonic means, which is $\frac{2 \times y}{x+y} = \frac{2\sqrt{2}}{1+\sqrt{2}} = 2\sqrt{2}(\sqrt{2}-1) = 2(2-\sqrt{2})$, is the apotome. EUCLID developed further the principles of commensurability and incommensurability in general, he formulated the definitions of rationals and irrationals and distinguished different classes of the binom and the apotome. APOLLONIUS finally perfected the whole system on the same lines. From the Euclidean binom $a-\sqrt{b}$ he proceeded to the formation of trinoms $a+\sqrt{b}+\sqrt{c}$ and quadrinoms $a+\sqrt{b}+\sqrt{c}+\sqrt{d}$; similarly the apotome $a-\sqrt{b}$ is extended into $a-\sqrt{b}+\sqrt{c}$, and the medial line $\sqrt[4]{a}$ into $\sqrt[8]{a}$ and $\sqrt[16]{a}$.

In his translation THOMSON made the laudable effort to preserve the spirit and form of the original Arabic. However, by too strictly adhering to the letter and to grammatical rules the translation appears sometimes stiff, obscure and inadequate. In the following a few instances may be quoted.

On p. 63, instead of : « and was in my opinion the chief means of establishing exact distinctions and irrefragable proofs with respect to the above-mentioned quantities. For although later the great APOLLONIUS... added some remarkable species..., it was nevertheless THEAETETUS who distinguished the powers etc, » it should be : « As far as the right classification and irrefutable proofs are concerned, I think that it was this man (THEAETETUS) in particular, who laid the foundations of this science. After him, however, it was the great APOLLONIUS... that added some remarkable species... For it was THEAETETUS who distinguished the powers... EUCLID's object... was... APOLLONIUS distinguished the different kinds of the ordered irrationals etc. » More or less this translation is also sponsored by WOEPCKE (6) and SUTER, p. 13. *Allati la yalḥaquhā ṭa'nun* is correctly rendered by « irrefragable, irrefutable ». In the glossary, however, *ṭa'nun* is translated by « doubt, suspicion », which is not correct. The original meaning of ṭa'ana is « to pierce with the spear, attack, wound », and then « to pierce with the tongue, attack, wound with words ». It is only natural that the term was applied to the refutation of a proof or claim by an adversary in a trial or debate.

(6) *Essai d'une restitution etc.*, p. 34 seq.

In the Talmud the term occurs in the meaning of the pleas and claims of the contesting parties in a trial, opposing and attacking each other. JASTROW and LEVY, in their dictionaries commit the same error by registering the signification « suspicion » for *ṭa'anah*. *Ṭa'anat ha-beriyot* means « the attack of the people » on the good name and reputation of a person.

P. 64, instead of « it will not be unprofitable for us to consolidate the good which it contains », read : « it will not be superfluous to demonstrate by the commentary its profitable use ». Instead of « The soul... wanders hither and thither on the sea of non-identity (i.e. lacking all similarity of quality or accident) immersed in the stream of the coming-to-be and the passing-away, where there is no standard of measurement », I would suggest : « The soul... will err on the sea of destruction and confusion (7) and drown in the chaotic (8) change of a non-lasting world ». Instead of « This was the consideration which Pythagoreans and the Athenian stranger held to be an incentive etc. », read : « Such (9) was the opinion of the Pythagoreans. The Athenian stranger however, urged to particular care for these things, and regarded that man to be utterly foolish who thought little of them. »

On p. 69 : « On the other hand, the continuous quantities are not all irrational; for we refer the measurement of all magnitudes whatsoever to some regular limit (i.e. standard) recognised by us ». But if we are able to refer the measurement of « all magnitudes whatsoever » to a certain standard, then *all* the magnitudes should be rational. The right translation of *aqdār mā* is « of some (10) magnitudes ». PAPPUS says : « for we do refer the measurement of some magnitudes to a certain, conventional standard ». *Ḥadd ma'lūm muntaẓim* means « a definite, conventional standard ».

On p. 71 : « number not being plurality, the correspondence notwithstanding, but a defined plurality ». *Kathrat kayfa ma ittafaqat* means « any plurality, just as it happens »; hence to translate : « number not being any plurality whatsoever, but a finite plurality ».

An interesting term of multiplication is *ja'ala-l-ṭul alā-l-'arḍ*, « to put the length upon the breadth, to multiply length by breadth »; on p. 206, line 13. The usual Arabic term is *ḍaraba; ja'ala* is a translation of a Greek word which corresponds to the Latin term *facere*. cfr. « The Terminology of Multiplication » in *The Hebrew Union College Annual*, vol. 6 (1929), pp. 252 *seq*.

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(7) Read perhaps : *al-'adam wa-l-tashabuh*.
(8) *La niẓām lahā*, is « without order, chaotic »; cf. also SUTER, p. 14.
(9) Namely, in the allegoric meaning just described.
(10) So also SUTER, p. 18.

On p. 196, line 13, instead of *madhā* read *hādhā*. P. 203, lines 13, 17, instead of *jaḥm* read *ḥajm;* cf. also p. 278. At the end of the book the leaves are misbound. After p. 272 the pp. 277-280 are to be found, then follow the pp. 285-288, 281-284, 289-294.

SOLOMON GANDZ.

Ludwik A. Birkenmajer. — *Stromata Copernicana*, VII+402 p., Cracow, Polish Academy of Sciences, 1924. (In Polish)

Since 1892 Professor BIRKENMAJER has made everything touching the life and work of COPERNICUS his specialty. The year 1900, Jubilee year of the university of Cracow, saw the appearance of his « Mikolay Kopernik—Studia i Materialy Biografyczne ». In 1923 a popular monograph followed, « M.K. as Savant, Citizen and Creative Genius », while at intervals special papers had kept the subject steadily before the public. The volume under consideration was next in order, and in its preface we are given to expect that the author's hope may yet be fulfilled of achieving a definitive life of the astronomer.

In these « Cuttings », we have a rich shear of additions to our knowledge—the fruit of decades of tireless search, chiefly in the libraries of northern Europe—notably in Upsala. For vigilance and patience B. has long been famous. It may be doubted whether a scrap of paper or a scratch of the pen on any page of a document escapes his attention.

In these 15 chapters, of varying length, a variety of subjects is discussed. The second, which takes up one quarter of the book, analyses the study years at Cracow (1491-95). To them we shall return. The first and third deal respectively with the forebears of the great scholar on his mother's side, and with the argument advanced by some historians that COPERNICUS was a German (*Isis*, 5, 222). It is based largely on the fact that in 1496 in Bologna he inscribed himself in the *natio germanica*—a fact which is rightly shewn to prove either too much or nothing at all.

Four chapters are devoted to C.'s relations with other men of note. New evidence is brought to shew that CALCAGNINI cannot be held to have anticipated C. in his discovery. So too materials are set forth that shew up the failure of nerve of the Lutheran professor from Wittenberg, GEORGE JOACHIM RHETICUS, who was C.'s guest for some two years (1539-41). Light is thrown on the use the young student made of the years previous to registering in Cracow, and on his second return from Italy. Of more moment is the confirmation now brought as to the date of writing of the « Commentariolus », and fresh evidence as to what probably determined the astronomer in his break with the Ptolemaic system.

Finally we have two chapters dealing with letters and documents as yet unpublished, while in the ninth there are added as many more to the already known score of books, which COPERNICUS owned or used, and whose pages are replete with his comments or corrections. From these annotations Professor B. has drawn a rich store of news.

To report even briefly on all this would demand too much space. Only certain matters then can be mentioned; the more's the pity since the original is buried in a little known tongue!

Study of the new-found data, when correlated with known facts and checked by the university archives—*liber diligentiarum*, has enabled the author to arrive at an approach to the astronomer's *index lectionum*, his list of courses attended during the Cracow years. Even the hour of the day and the place of meeting can thus be established. Of ten courses now determined all but the first two « belonged to the higher course in mathematics, which with the exception of astrology were part of the requirements for the A.M. degree. » We are assured that much more can still be done to complete this line of research.

As a part of all this the question pops up as to what the young COPERNICUS learned from the shining light of the university in his day, Master WOYCIECH OF BRUDZEW—*insignis mathematicus*, a colleague of the eminent humanist CALLIMACHUS and friend of his own uncle the Bishop of Ermland. Since the days of BROZEK (d. 1652) all biographers of C. have taken a close relation between the two for granted. Pursuing his investigation *sine studio et ira*, Professor B. has shewn that C. never « heard » the famous master; but only used his « Commentary », or heard it used, when taking the course of the young Master SIMON OF SIERPIEC, who expounded in the summer semester of 1493 PEURBACH's « New Theories of the Planets ».

Similarly tradition has long maintained that COPERNICUS « heard » the two eminent teachers, MICHAEL OF BRESLAU and JOHN OF GLOGOW. Our author has now established the facts of these two courses; and we learn that it was the former's lectures on the Almanach, prepared yearly by the university on lines originally laid down in the famous Toledo tables of King ALPHONSO, which C. attended in the winter semester of 1493. So too in the summer of the following year he followed the course of JOHN OF GLOGOW on Geography.

But what interests us most is the new light thrown on the intellectual development of the great scientist. Professor B. has unearthed a work marked by cataloguers *rarissimo*,—of which the university of Cracow possesses a copy, and of which the canonry of Frauenburg did possess one before the looting by the troops of GUSTAVUS ADOLPHUS, whose

internal evidence is proof of the uses COPERNICUS made thereof. It is an Outline of Knowledge, published by ALDUS in 1501, the work of a distinguished physician and humanist, GEORGE VALLA : of which both the expression and sentiment in many places betrays striking likenesses to the Polish masters' writings.

In both works the Greek names of the stars are used instead of the Arabian—even to mistakes in spelling of which COPERNICUS is guilty! But most vital of all is the fact that VALLA in the heart of his work brings the famous treatise of PLUTARCH in Latin translation—the first in Europe, in which the heliocentric system of ARISTARCHUS is elaborated.

When and where could C. have got his hands on this book? Most likely in 1502 in Padua, and that from the hands of his tutor and friend NICCOLO LEONICO, of whom we know that for long he stood in close relations to his much older and now deceased friend VALLA. The obvious conclusion is that from this time on the Polish investigator was committed to the new view, and his first formulation of it was soon set down in the « Commentariolus ».

Already in 1900 Professor B. argued for the early date of this sketch, not later then than 1512. He now furnishes us with a striking bit of confirmation, which has turned up in Cracow. It is found in a catalogue of his own personal library, made by the illustrious physician and humanist, MATTHEW OF MIECHOW, and that in the year 1514. While listing the contents of a beech-wood drawer he uses these words :

Item sexternus Theorice asserentis terram moveri, solem vero quiescere !

In English :

Next a pamphlet with this view set forth that the earth moves, while the sun stands still !

Whose else than COPERNICUS ? and what else if not the Commentariolus ?

For a final clinching of this argument our author looks far away—to Leningrad. The MIECHOW library was burned in 1733. What books escaped were mostly taken to Warsaw in 1819, and thence carried off by the Russians a decade later. Did the precious sketch escape ? Stranger things have happened.

WILLIAM J. ROSE.

(Dartmouth College, Febr. 1, 1931).

Wilmer Cave Wright. — *Hieronymi Fracastorii De Contagione et Contagiosis Morbis et Eorum Curatione, Libri III.* Translation and Notes. History of Medicine Series issued under the auspices of the Library of the New York Academy of Medicine, No. 11. G. P. PUTNAM's Sons, New York and London, 1930. LVII + A-F + 356 pp., 2 pl.

It is most encouraging that « classical » scholars are contributing more and more of their special talents to the interpretation of scientific tracts hitherto available only in the difficult original. Dr. WRIGHT has set a very high standard of achievement in this field by her accurate and skillful translation of JEROME FRACASTOR's (1478-1553) important treatise *Contagion, Contagious Diseases and Their Treatment* (Venice, 1546), which is embellished with a well-organized and authoritative bio-bibliographical introduction, and with copious and enlightening notes. With the encouragement of Dr. HAVEN EMERSON, the volume appears under the auspices of the Library of the New York Academy of Medicine as Number II of its *History of Medicine Series*. Auspicious inaugural to an important series : may the excellence of all volumes in it rival this !

1930 witnessed a considerable revival of interest in FRACASTOR (in addition to the present volume other items on some new but unimportant material appeared in *Calif. West. Med.*, 33:739, 1930, and *Ann. Med. Hist.*, n.s. 2:711, 1930), due chiefly to its being the four hundredth anniversary of his remarkably successful medical poem *Syphilis sive Morbus Gallicus* (Verona, 1530), from which the disease took its name. The scientific significance of FRACASTOR's work, especially in regard to his analysis of « contagion, » has been keenly appreciated by those scholars who have studied it (OSLER, W., *Proc. Charaha Club*, 2:8, 1906; GARRISON, F. H., *Science*, Apr. 1, 1910; KLEBS, A. C., *Bull. Johns Hopkins Hosp.*, 26:378, 1915, *Ann. Med. Hist.*, 1:220, 1917; SINGER, C. and D., *Ann. Med. Hist.*, 1:1, 1917), but the present effort, in addition to being the most comprehensive evaluation of his ideas on infection yet to appear, is certain to make historians generally more aware of his importance in the development of a great intellectual movement. For his was the first telling attack on the supremacy of the classical tradition wielded by GALEN in natural science and medicine.

Against a cleverly devised background of the political and social aspects of the first half of the 16th century, Dr. WRIGHT presents in her introduction an excellent account of the life, character and work of FRACASTOR. His *Syphilis* is extremely well discussed. BOLL's explanation (*N. Jahrb. f. d. Kl. Alt.*, 25 :72, 1910) of the derivation of the word *syphilis* from the tale in OVID, *Metamorphoses V*, of SIPYLUS, son of NIOBE, is accepted as the most plausible. A brief consideration is given of FRACASTOR's ideas on astronomy, geology, psychology, and poetry. His religious orthodoxy and astrological views are justly excused in the light of the sentiments of his times. His iconography and manuscripts are also discussed.

The translation is flawless and is presented page by page opposite the Latin. The first part is devoted to a general philosophical discussion

of contagion. An important passage occurrs in the second chapter : « There are, it seems, three fundamentally different types of contagion : the first infects by direct contact only; the second does the same, but in addition leaves fomes, and this contagion may be spread by means of that fomes, for instance scabies, phthisis, bald spots, elephantiasis and the like. By fomes I mean clothes, wooden objects, and things of that sort, which though not themselves corrupted can, nevertheless, preserve the original germs of the contagion and infect by means of these; thirdly, there is a kind of contagion which is transmitted not only by direct contact or by fomes as intermediary, but also infects at a distance, for example, pestilent fevers, phthisis, certain kinds of ophthalmia, exanthemata of the kind called variolae, and the like. These different contagions seem to obey a certain law; for those which carry contagion to a distant object infect both by direct contact and by fomes; those that are contagious by means of fomes are equally so by direct contact; not all of them are contagious at a distance, but all are contagious by direct contact. » This is a fair example of FRACASTOR's skill at analysis and of the translator's style.

In Chapter IX of this first book, FRACASTOR raises the significant question, « Is every contagion a kind of putrefaction ? » and concludes affirmatively. This was the intellectual step taken experimentally by PASTEUR. The first book concludes with a discussion of the differentiation of contagion from poisons, and of the signs of contagion.

Book II. *Contagious Diseases*, begins, « The natural sequel to the preceding Book is a discussion, one by one, of the contagious diseases that are known to us, their nature, the causes that produce them, and how they differ from one another. » There follows a discussion of the poxes and measles, pestilent fevers, the ephemeral pestilent fever in Britain (« sweating sickness »), typhus, the plague, contagious phthisis, rabies, syphilis, elephantiasis, leprosy, scabies, and cutaneous infection. The discussion is excellent even from the modern point of view. Book III takes up in detail the treatment of the diseases mentioned in Book II. Here the high rational tone of what has preceded is marred by the uncritical inclusion of all sorts of traditional and folklore remedies. It is interesting that the idea of a specific curative agent for a certain contagion did not occur to FRACASTOR, although his great contribution was a logical exposition on good clinical evidence of the specific character of infectious diseases. The recognition of cinchona bark as a specific curative agent for « intermittent fevers » (malaria) about a century later (1640) focused attention to this proposition, and emphasized the importance of FRACASTOR's ideas. Prof. W. H. WELCH has recently ventured the opinion that FRACASTOR's work and the practical success of cinchona had a greater

effect in overthrowing traditional Galenism and the ancient humoral pathology than the more academic contributions of VESALIUS and HARVEY (*Ann. Med. Hist.*, n.s. 2:712, 1930).

Dr. WRIGHT's useful annotations are gathered together and form a separate section following the translation. This is not quite as convenient as if they were placed as foot-notes to the translation. Very few errors of any sort have been noted. The first edition of VESALIUS' *Fabrica* appeared at Basle in 1543, instead of at Venice (p. 311). The bibliography of FRACASTOR, while incomplete, is the best so far published. The index is satisfactory but not very full.

CHAUNCEY D. LEAKE.

Marjorie Hope Nicolson. — *Conway Letters.* The Correspondence of ANNE, Viscountess CONWAY, HENRY MORE, and their Friends, 1642-1684. XXVII+517 p. New Haven, published by Yale University Press and to be sold in London by HUMPHREY MILFORD, Oxford University Press, 1930.

Ce livre plein de charme où l'on trouve les reflets de passions toutes platoniques mêlées à des accents prématurément romantiques mérite de ne pas échapper à l'attention de l'historien de la science, et surtout de la médecine, car, bien qu'une sélection seulement des documents recueillis nous soit offerte, leur ensemble constitue néanmoins une remarquable chronique de la vie et de la pensée au dix-septième siècle et, comme on va le voir, une contribution d'une extrême richesse à un chapitre de l'histoire de la science qui n'a pas encore été écrit : l'histoire, au dix-septième siècle, de la science qui se fixe et se diffuse au fur et à mesure que se rétrécit le domaine de la fable et de la superstition. On comprend que les historiens aient reculé jusqu'à présent devant la tâche ardue de démêler les premières aventures de la pensée scientifique faisant son entrée dans le monde, dans le domaine social. Il n'est pas facile en effet de décrire et d'imaginer le chaos qui caractérisait l'atmosphère scientifique de jadis. Aujourd'hui, la science nous est facile à comprendre, pour peu que l'on ait saisi les grands principes directeurs dans chacune de ses branches. La complexité d'autrefois a été réduite à quelques hypothèses, à un nombre relativement petit de concepts. Mais au grand siècle, c'était l'obscurité de tous côtés; et le public éclairé, sans contact avec les figures dominantes de la science, aurait été livré au hasard s'il n'avait eu pour le guider ces auteurs secondaires dont on ne rencontrera jamais les noms dans l'histoire du progrès car ils n'ont joué aucun rôle dans la science « in the making », mais dont on devra cependant tenir compte un jour, puisque on ne peut nier qu'ils aient souvent, plus que les maîtres, contribué par leur influence directe à modifier l'attitude

de la société cultivée. Faut-il rappeler par exemple que NEWTON n'est cité ni par PEPYS, ni par EVELYN ? De même, le nom de FRANCIS BACON n'apparaît dans aucune des 287 lettres qui nous sont offertes ici (1).

Le personnage principal dont nous faisons la connaissance grâce à Miss NICOLSON pourrait bien être « the most remarkable woman, the editor believes, of that remarkable age » (p. XXIV) : ANNE CONWAY fit incontestablement preuve du plus rare mérite en métaphysique. Née en 1631, elle était la sœur cadette de HENEAGE FINCH, qui allait devenir Lord Chancellor et Lord Keeper, et de JOHN FINCH, médecin éminent qui fut nommé ambassadeur à Constantinople en 1672. Lorsqu'elle épousa en 1651 EDWARD, vicomte CONWAY, personnage sympathique, sans plus, membre de la Royal Society (1667/8), elle souffrait déjà de migraines persistantes qui pendant plus de trente ans firent de son existence un long martyre, et dont la violence sans cesse accrue l'obligea à passer au lit le plus souvent ses vingt dernières années. HARVEY, MAYERNE, les deux RIDGELEY, FRANCIS PRUJEAN, TH. WILLIS, BOYLE, VALENTINE GREATRAKES et F. M. VAN HELMONT investiguèrent le mal mystérieux qui torturait la malheureuse. HARVEY était le médecin des CONWAY (sur ses relations avec la famille FINCH, voir son testament). Il suggéra la trépanation, mais, décidée tout d'abord à subir cette opération, ANNE CONWAY y renonça dans la suite. Elle fut aussi, comme FLAMSTEED, entre les mains de GREATRAKES, charlatan ingénu pour qui BOYLE professait de l'admiration et qui à plus d'un égard fait songer à RASPOUTINE. Enfin, on eut recours au fils du grand VAN HELMONT, F. M. VAN HELMONT (1614-1698), aventurier extraordinaire, mystique et cabbaliste passionné, qui durant dix-sept mois avait médité à loisir dans les prisons de l'Inquisition, « perhaps the most universally known character of the seventeenth century » (?) (p. XXIV). Il passa neuf années — de 1670 à 1679 (2) — presque continuellement au chevet de la vicomtesse ; celle-ci, sous son influence et celle de WILLIAM PENN notamment, fit en 1677 une conversion au quakerisme sur laquelle tous jugèrent bon de s'attendrir, sauf HENRY MORE, le platonicien de Cambridge, son correspondant principal ; il restait fidèle à l'Église d'Angleterre, et cette date marque le terme de son commerce d'esprit avec la noble philosophe. L'agonie d'ANNE CONWAY prit fin le 23 février 1678-9. MORE lui survécut. La piété le mena jusqu'à l'âge de 73 ans. Son amie laissait un petit traité inachevé, publié en 1690 à Amsterdam, où elle tentait a réconciliation de la science et de la religion, préoccupation fort anglaise

(1) Il y a là, sur l'influence véritable « du père de la philosophie expérimentale » comme disait VOLTAIRE, une indication qui mérite d'être retenue.

(2) De 1671 date le début des relations de VAN HELMONT avec LEIBNIZ.

assurément et qu'on lui pardonnera d'autant plus volontiers que la plupart de ses compatriotes ne nous ont pas encore accoutumé à mieux. Cet opuscule produisit une vive impression sur LEIBNIZ, comme en attestent de nombreux documents.

Ce qui précède suffira, je pense, à convaincre le lecteur que « ANNE CONWAY's life is in itself a history of seventeenth-century medicine, illustrating both its genius and its superstitions » (p. 10). Certes, MISS NICOLSON ne nous confie qu'une partie seulement de sa moisson dans les bibliothèques et fonds anglais : par exemple, trois lettres où MORE discute des passages du *Discours de la Méthode* n'ont pas été reproduites; d'autres lettres de lui ont été écourtées. Toutefois, l'ensemble des lettres de TURQUET DE MAYERNE, K. DIGBY, JOHN FINCH, GREATRAKES et MORE (151 lettres de ce dernier sont publiées ici !) remplissent la plus grosse partie de l'ouvrage. Dès lors, si l'on veut bien considérer qu'un grand nombre de ces documents nous sont pour la première fois rendus aisément accessibles, on réalisera l'abondance de cette source nouvelle où devront puiser tous ceux qui entreprendront d'étudier l'histoire sociale de la science à une époque « when man was becoming aware—as never since Greek drama first stirred the minds of men had he been aware—of the relentless inevitability of a cosmos governed by cause and effect » (p. XXVII).

L'ouvrage est édité avec un soin et un sens de la mesure dont il convient de féliciter l'auteur. On voit des portraits des principaux personnages. Une critique cependant : il est hautement regrettable que les presses universitaires de Yale fassent usage de caractères si minuscules. (1)

J. PELSENEER.

Johannes Walther.— *Goethe als Seher und Erforscher der Natur.* Untersuchungen über GOETHES Stellung zu den Problemen der Natur. Mit 15 Tafeln nach Originalen im Goethehaus zu Weimar. VIII+ 324 S. (Herausgegeben im Namen der Kaiserlich Leopoldinischen Deutschen Akademie der Naturforscher zu Halle). 1930.

Under the leadership of its nineteenth president, JOHANNES WALTHER, the Leopoldina is experiencing a kind of Renaissance, of which this beautiful volume is but one fruit among many others. The members of the Academy have recognized their debt to their vigorous leader, witness the Festschrift dedicated to him last year on the occasion of his seventieth birthday (*Isis*, 15, 434). The present volume is dedicated by

(1) Mentionnons, entre autres publications de Miss NICOLSON, un intéressant article : « The early stage of Cartesianism in England » (*Studies in Philology*, XXVI, 1929, pp. 356-374).

the Academy to the study of the scientific ideas of one of its most illustrious members, JOHANN WOLFGANG GOETHE, who was elected in 1818 under the presidency of C. G. NEES VON ESENBECK (1776-1858), one of the earliest botanists to appreciate GOETHE's views on the metamorphoses of plants and one of the chief representatives of that Naturphilosophie movement of which we are now attending a curious revival.

The diploma signed by NEES read as follows :

« Bene sapienterque majores nostri instituerunt, ut non solum Viros medica eruditione excellentes, sed aliis quoque artibus atque scientiis conspicuos, nobiscum in societatem conjungerent, quo academia nostra membrorum suorum tam dignitate nominisque excellentia quam communi in opera academica consensione emineret. Quam ob rem etiam haud mirari poteris *Vir perillustris* ac *Generosissime*, quod cum ob variam istam multiplicem et amplam, quae in Te est, eruditionem, nominis Tui maxima sit inter nos commemoratio celebritasque eximia; Tuo etiam imposterum frui honorificentissimo sodalitio, in votis habeamus. Accedit insuper, quod multis jam modis luculentissime dederis declaratum, quam propensus animus Tuus sit ad promouendas adjuvandasque doctrinas physicas, quae ad nos propius spectant. Ingredere itaque eandem nobiscum viam, naturam scrutandi, macte *Tua* virtute! et accipe in signum nostri Ordinis, cui Te lubentissime adscribimus, cognomen *Arion*, quo amicissimum collegam Te hodie prima vice salutamus. Vale interim, *Vir perillustris*, amplissimaque et gloria utere et fortuna, perpetuis accessionibus cumulata. »

The nickname ARION was given to GOETHE in accordance with a very curious custom of early academies, recalling their secret tendencies, namely, that of calling each member by a special name which was his only as a member of the fraternity. In the Leopoldina that custom survived until as late as 1870. GOETHE was in reality Arion IV ! (LINNÉ was called Dioscorides II; the princess CATHERINE ROMANOVNA DASHKOVA, whom CATHERINE II had appointed president of her own academy, was called Urania arctoa, A. P. DE CANDOLLE, Linnaeus I; ADALBERT VON CHAMISSO, Jason VIII; LOUIS AGASSIZ, Artedi; J. F. BLUMENBACH, Aristotle IV; JUSTUS V. LIEBIG, Gay-Lussac; the Prince-consort ALBERT, Fridericus secundus Hohenstaufensis !)

The present volume is admirably printed and illustrated by means of 15 plates reproducing GOETHE's drawings (in black and in color) and by a beautiful portrait (GEORGE DAWE, 1819). It contains the following papers :

JOHANNES WALTHER : GOETHE und die Leopoldina;

C. G. CARUS, 13th president of the Academy (1789-1869) : GOETHES Verhältnis zur Natur und Naturwissenschaft;

THEODOR ZIEHEN : GOETHES Naturphilosophische Anschauungen;

JOHANNES WALTHER : GOETHE als Seher und Erforscher der Natur;

HANS SCHULZ : GOETHE und sein Hallescher Freundeskreis;

FERDINAND VON WOLFF : Über den Goethit;
GEORGE KARSTEN : Über die Pflanzengattung Goethea;
JOHANNES WALTHER : Eine Alraune aus GOETHES Hand;
WILHELM LOREY : GOETHES Stellung zur Mathematik;
KARL WESSELY : Welche Wege führen noch heute zu GOETHES Farbenlehre?
OTTO KERN: Die Metamorphose in Religion und Dichtung der Antike;
GÜNTHER SCHMID : Die Metamorphose der Pflanze;
RUDOLF DISSELHORST : Die anatomischen Arbeiten GOETHES;
JOHANNES WALTHER : GOETHE und das Reich der Steine.

To that fine collection might still be added another paper also published by the Leopoldina, but in another volume (*Berichte*, Band 6, 15-61, 1930), namely GÜNTHER SCHMID : GOETHE und die Nova Acta der Leopoldinisch-Carolinischen Deutschen Akademie der Naturforscher.

GOETHE's fame is so secure that it is independent of celebrations, yet we rejoice that the venerable Leopoldina has been moved to build this beautiful monument to his memory, not for his sake, but for her sake and for ours. GOETHE does not need us, but we need him.

31.01.10 GEORGE SARTON.

Harry B. Weiss and **Grace M. Ziegler.** — *Thomas Say : Early American Naturalist.* Foreword by L. O. HOWARD. CHARLES C. THOMAS, Springfield, Ill., 1931. XIV+260 pp., 27 illust., $ 5.00.

Early American descriptive naturalists have not generally received much consideration in the history of science, probably because they came toward the close of the great descriptive period in the development of biological science, and maybe also because they were looked upon more as collectors than as scientists by the great European biologists. Not even JOSEPH LEIDY (1823-1891) has been accorded the treatment he deserves, although W. S. MIDDLETON has prepared an excellent sketch of him (*Ann. Med. Hist.*, 5:100, 1923). The appearance of this splendid account of the life of THOMAS SAY (1787-1834), beautifully designed and printed, may do much to correct this injustice.

THOMAS SAY came from a distinguished Philadelphia family. His grandfather, THOMAS SAY (1709-1796), was a Quaker physician with strong theological interests, and his father, BENJAMIN (1756-1813), was also a Quaker physician, a charter member of the College of Physicians (1787), an organizer of the Humane Society (1793), an enthusiastic supporter of FITCH's steamboat experiments (1787) and a member of Congress. Educated in a Quaker school, SAY was early induced by WILLIAM BARTRAM, son of the botanist, JOHN (1699-1777), to collect natural history specimens, and this he continued as a life work.

In 1812 a group to which SAY belonged organized the Philadelphia Academy of Natural Sciences, and this became his headquarters. Except for service in the War of 1812, he now devoted all his energies to the classification and description of American insects, his *American Entomology* appearing in Philadelphia in 1817. In this year WILLIAM MACLURE (1763-1840), pioneer American geologist, became president of the Academy and SAY's most influential friend. MACLURE it was who persuaded SAY in 1825 to join ROBERT OWEN's communistic colony « New Harmony » in Indiana, where he died in 1834. Meanwhile SAY had been naturalist to the LONG expeditions to the Rocky Mountains (1819-1823), Professor of Natural History including Geology at the University of Pennsylvania (1822-1828), and had contributed voluminous papers on all phases of natural history to scientific journals. He had an extensive foreign correspondence and was recognized by membership in foreign societies.

SAY is said to have described 1150 species of Coleoptera, 225 species of Diptera, 100 species of Hemiptera, and many others. His revised *American Entomology* (1824-1828) ran to three volumes. All his writings on entomology were edited by J. L. LE CONTE and published in 1859 in New York. W. G. BINNEY similarly edited his writings on conchology (New York, 1858). In his wife, LUCY SISTAIRE (1801-1886), whom he married in 1827, SAY found a great help, who carried on much of his work after his death, and who was honored by life membership in the Academy of Natural Sciences.

This biography of the « father of American entomology » is excellently organized and gives a clear picture of the interest in natural science in this country in the early part of the 19th century. There is good bibliographical material and a good index. Many long quotations are given from SAY's correspondence and the illustrations are valuable.

CHAUNCEY D. LEAKE.

William George MacCallum. — *William Stewart Halsted, Surgeon.* XVIII+241 p., 15 pl. Baltimore. The Johns Hopkins Press, 1930 ($ 2.75).

The subject of this intimate and interesting biography was a surgical inheritor of CLAUDE BERNARD. For him surgery was an experimental science in which experiment should precede and follow every new operative attempt. In Baltimore, where much of his experimental work was done, the fusion of surgery and physiology was most intimate. Medical education as fostered and developed there was above all biological where future surgeons were trained in a laboratory of experimental surgery in contact with living beings, and not in the dissecting room. In this

tenor wrote LERICHE of Strasbourg of the work and influence of HALSTED.

The span of his life, 1852-1922, covered the years in which the art of surgery came to its present perfection through the discoveries of PASTEUR and their applications by LISTER. In this transformation in the United States HALSTED took a leading part. He was an indefatigable worker, took infinite pains in the perfection of his surgical technique, and most of all was a persistent investigator of the processes of the healing of wounds. Perhaps his greatest contribution to the art of surgery rests upon his demonstrations of the importance of restoration of nautral contacts of tissues, of the value of the blood-clot in the healing processes, and of the indirect influence of the reduction of injury to tissues and to blood vessels upon the prevention or suppression of infection. He realized the value of the natural defenses of the organism.

To VON BERGMANN and SCHIMMELBUSCH is to be credited much of the idea of aseptic surgery in which the exclusion of bacteria is the aim. But HALSTED demonstrated that in the absence of tissue damage bacteria could be introduced into the peritoneal cavity of the dog with no ill effect, but if tissue were bruised or its blood supply cut off, peritonitis ensued. It was Nature's method which HALSTED brought to the aid of the surgeon's artifices, and upon it, rather than upon infection, he focussed attention.

HALSTED lived through the period of surgical daring which followed the application of general anaesthesia to operative procedure. His was a conserving and steadying influence, for his method was scientifically centered upon the welfare of the patient to be sought by the restoration of normal conditions. To this end he sought to avoid tubes, gauze, and catgut as liable to increase irritation and foster infection. He introduced the use of gutta percha tissue and silver foil. He sought not so much to build surgery upon either aseptic or antiseptic technique, but rather to make the major aim the maintenance of the normal defenses by conserving the normal blood supply and avoiding injury to tissues.

His contributions to the surgery of the thyroid and to the necessity of retention of the parathyroids are noteworthy. He created block anaesthesia now so widely in use in dental work, introduced the surgical use of rubber gloves, demonstrated the value of radical removal of large areas in cancer of the breast, and monographed the surgery of goitre and of the great arteries.

The author has given a very interesting character sketch of this great surgeon and an illuminating account of his contributions to surgery and to high standards of surgical education. The growth of his intellectual grasp upon surgical problems and the mastery of the technique for their solution is particularly well portrayed by the biographer.

The book contains a number of interesting portraits of HALSTED, a chronological list of his surgical achievements, and a bibliography of articles dealing with his life and work. The introduction by Dr. WILLIAM H. WELCH is a fine appreciation of HALSTED's creative work in the establishment of a school of surgery.

December 30, 1930. CHARLES A. KOFOID.

Mathematischer Papyrus des Staatlichen Museums der Schönen Künste in Moskau, herausgegeben und kommentiert von W. W. STRUVE, unter Benutzung einer hieroglyphischen Transkription von B. A. TURAJEFF. (*Quellen und Studien zur Geschichte der Mathematik*, Abteilung A : *Quellen*, vol. 1). Berlin, SPRINGER, 1930. 12+198 p. + 10 long folding plates. 8vo. Price 48.80 marks, unbound.

Among Egyptian mathematical documents written before the Christian era only two are of considerable extent. One of these, the Rhind Mathematical papyrus, dating from about 1650 B.C. has appeared, in practically complete form, in three editions, by EISENLOHR (1877), by PEET (1923), and by CHACE, MANNING, and BULL (1927-29) (1). The second document, now first published completely in the work under review, is a palimpsest dating from about 1850 B. C. It was purchased about 1893 by the Russian Egyptologist Professor GOLENISHCHEV (2), former custodian of the Egyptian collections in the Hermitage Museum, Leningrad, and later professor in the Egyptian University at Cairo. Already in the second edition (1894) of the first volume of CANTOR's history there is a reference to it. But it was not till TURAEV's article in *Ancient Egypt* (3) in 1917, that anything was known as to the contents of this papyrus. At this time it was in the Museum of Fine Arts, Moscow, where it had been placed in accordance with an arrangement of 1912 made with the Russian Government by GOLENISHCHEV, whereby he was to receive an annuity for life in return for making over to the Government his

(1) My extensive Bibliography of Egyptian and Babylonian mathematics appeared in both volumes of this work. In the course of this review it will be referred to as « Bibliography. »

(2) Here, and later, I have used the British Museum rather than a German method of transliterating Russian names arising in the discussion of this publication. Regarding the purchase see the statement of GOLENISHCHEV in my Bibliography.

(3) It was five years before the article became known to mathematicians. Sir FLINDERS PETRIE drew my attention to it in the summer of 1922 and in September I spoke especially of its contents, exhibiting the number of *Ancient Egypt*, in an address delivered at Rochester, N.Y., before members of the American Mathematical Society and of the Mathematical Association of America. Without reference to this address, Professor L. C. KARPINSKI, who had heard it, reported some of the facts in *Science*, vol. 57, 1923, p. 528.

immensely valuable Egyptian collections. Not a cent of this annuity has been paid since 1917.

TURAEV's article dealt almost exclusively (4) with the remarkable problem concerning the volume of a truncated pyramid. A facsimilie of the part of the papyrus containing the problem was given, also the hieroglyphic transcription, and a translation. This problem aroused great interest, and it speaks volumes for the generosity of the authorities of the Museum of Fine Arts that its director allowed several scholars to procure photographic copies of the whole papyrus. In this way Professor PEET was enabled to write his commentary on the Rhind papyrus with the photographs of the GOLENISHCHEV papyrus before him.

Shortly before his death, TURAEV presented to the Academy of Sciences of Leningrad TSINERLING's paper on « geometry in ancient Egypt ». It was not published till 1925, and then, probably, in much extended form. Detailed discussion of the article is given in my Bibliography (1927), but it may be noted here merely that, among other things, TSINERLING gave TURAEV's hieroglyphic transcription, and translations, of five problems, only four of which were geometric, one of these being the same as the one published in 1917. Some new portions of the papyrus were published in facsimilie. These four geometrical problems were the subject of a notable, and probably definitive, study by GUNN and PEET (*Journal of Egyptian Archaeology*, Nov., 1929).

For most of the interesting facts concerning the Golenishchev papyrus in my Bibliography and in my paper on « Mathematics before the Greeks » (5), I am indebted to the extraordinary kindness of Professor STRUVE who placed most detailed information in my hands three years ago, when he was already working on his edition of the papyrus.

Before dealing more particularly with this edition it may be worth while to note other smaller Egyptian documents of mathematical interest, and dated before the Christian era. The Hierakonopolis mace at Oxford, c. 3500; Akhmîm tablets at Cairo, c. 2000; Kahun papyri in London, c. 1850; Thebes papyrus 6619 at Berlin, c. 1850; Leather roll 10250 at London, c. 1650; Tablet 7798 at Berlin, c. 1650; Papyri 9784, 9785 at Berlin, c. 1465; Karnak water clock at Cairo, c. 1400; Temple inscription at Edfu, c. 100. Facts concerning these and other documents are to be found in my Bibliography.

(4) There is a somewhat misleading and unintelligible reference to a problem defining « the length of the sides of a quadrilateral, when the relation of the sides and area of the quaderlateral are known ». But the problem is simply : Given the area of a rectangle, and the ratio of the length of its sides, find the lengths of the sides.

(5) *Science*, vol. 71, 1930, p. 109 f.

Throughout his work Professor STRUVE is most meticulous in rendering full credit to everyone who has in any wise assited him ; and thus the fact is prominently set forth that he made what use he could of TURAEV's transcription, which must have been of great assistance in a pioneer work of such difficulty, even though more than once he explains why he cannot agree with TURAEV's reading.

The original Rhind papyrus and the Golenishchev papyrus with its nine fragments are of practically identical lengths, 544 cm. But while the former is 33 cm. in height, the latter is only about one quarter of this, 8 cm., a most unusual height (only two other of this kind are known) suggesting either that the papyrus was intended for frequent use, or that the narrow strip was the only writing material available to the author.

In the Rhind papyrus there is writing on both sides and it consists of the 2/*n* table and parts numbered by EISENLOHR 1 to 87, practically all of which may be appropriately referred to as problems. The Golenishchev Papyrus as reconstructed by STRUVE contains 45 columns distributed among 25 problems. Let us consider these in groups.

Enough seems to be given in the case of the fragments of problems 2 and 3 to suggest in most aggravating fashion that questions connected with the rudder and mast of a ship are considered. No problems of this kind are found elsewhere. The extraordinary development, among the ancient Egyptians, of the art of building ships of great variety and strength, not only for use in the Nile but also in the Mediterranean, is set forth in the monumental work of CHARLES BOREUX, *L'Art de la Navigation en Égypte jusqu'à la fin de l'ancien empire*. Cairo, 1925. (STRUVE gives this date as 1924, perhaps that of the first part of the complete work.)

In a second group of the 25 problems are no fewer than 10 (5, 8, 9, 12, 13, 15, 16, 20, 22, and 24), so-called *pefsu* or cooking-ratio problems. The *pefsu* is the number of units of food or drink that could be made from a unit of material in the process of cooking, and it determined the relative value of any food or drink; the lower the *pefsu* the more valuable the unit of food. The *pefsu* of a loaf of bread is simply the number of such loaves which can be made out of a *hekat* of corn.

Among the 10 *pefsu* problems (a) the thirteenth, except for a mistake, is identical with the ninth; (b) the fifth, except for its brevity, is identical with the eighth; (c) the twenty-second as stated is impossible of solution. The text gives information equivalent to solving the following problems :

15. Given 10 *hekat* (6) of grain, how many *des* of beer of *pefsu* 2 can be made?

(6) I have used *hekat* where STRUVE uses *Scheffel*, the equivalent of which is usually given as « bushel ». PEET incorrectly gave bushel for *hekat*, in the same sentence which indicated that there were 292 cubic inches in a *hekat*, which

[It is assumed that a *hekat* of grain makes 2 *des* of beer.]

24. If a part of 15 *hekat* of upper Egyptian grain is made up into 200 loaves of bread and the rest into 10 *des* of beer; if, furthermore, the *pefsu* of the beer is to be 1/10 that of the bread, what is the *pefsu* of each?

9. Part of 16 *hekat* of upper Egyptian grain is used in making 100 loaves of bread of *pefsu* 20 and part in making equal quantities of three kinds of beer of *pefsu* 2, 4, 6 respectively. The equivalent of this beer is *besha* (7) date beer of double the strength; how much of this beer would correspond to each of the other kinds?

8. Given 100 loaves of bread of *pefsu* 20 to be exchanged for *besha* date beer of *pefsu* 4. Find the number of *des* of beer.

12. Given that 13 *hekat* of upper Egyptian grain is made into 18 *des* of *besha* date-substitute beer and that 1 *des* of this makes 2 1/6 *des* of barley beer. What is the *pefsu* of the barley beer.

20. How many *hekat* of barley would be necessary to make 1000 loaves of *emmer* bread of *pefsu* 20, if 1 loaf of *emmer* bread and two-thirds of a loaf of barley bread have equal value.

16. [This difficult problem is especially interesting because a beer of great alcoholic strength is derived from two others.]

STRUVE devotes 54 pages (44-98) to the discussion of these 10 *pefsu* problems. In the Rhind papyrus there are also 10 *pefsu* problems but as a group they are simpler and less interesting than these of the Golenishchev papyrus.

Problem 21 is closely related to *pefsu* problems, and in particular to Problem 74 of the Rhind papyrus. It is as follows :

Of offering-cakes there are 20 of one kind, for each of which 1/8 of a *hekat* of corn is necessary; and 40 of another kind, for each of which 1/16 of a *hekat* is needed. Show that 1/12 of a *hekat* would be used for each of 60 cakes of a third kind, if the total amount of corn used is that necessary for the first two kinds.

STRUVE next groups problems 11 and 23.

11. From the storehouse of a bakery a worker ordinarily carried a certain number of loaves in a square basket, five loaves on a side. If he had to use a basket holding only four loaves on a side, to what extent would his work be

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GUNN points out is nearer a gallon. One equivalent of *Scheffel* is 50 litres, which would not, therefore, be a proper equivalent of a *hekat*.

(7) STRUVE translates this Egyptian word *besha* by spelt, which seems to be questionable; ERMAN and GRAPOW say (*Wörterbuch*, vol. 1, 1926, p. 478) a kind of grain or fruit. PEET states (Rhind, p. 114) that *bôdet* is a kind of spelt much cultivated in Europe and known in Germany as *Emmer*. This translation of *bôdet* is used by STRUVE in problem 20. STRUVE suggests that while « upper Egyptian grain (problems 9, 24) probably means barley, « lower Egyptian grain » might correspond to *Emmer*. I have been unable to find the word *Emmer* in any one of half a dozen German dictionaries, including those of GRIMM, WIEGAND, SAUNDERS, and FLÜGEL-SCHMIDT-TANGER.

increased by using the smaller basket? [The solution given takes account of the difference in the number of loaves for each trip, that is $x^2 = 5^2 - 4^2$, in the form $(x/4)^2 = (5/4)^2 - 1$.]

Problem 23 is a regular rule-of-three problem:

A sandalmaker works for 15 days receiving wages every five days. If he does the work in 10 days, after what periods should he be paid? [It is tacitly assumed that the days in the two cases are of different lengths, that the length of an ordinary to an extraordinary working day is as 2 : 3.]

The next group (25, 19, 1) consists of *aha* or quantity problems, such as are found in the Rhind papyrus (nos. 24 f.), in the Kahun papyri, and in Berlin papyrus 6619. In problem 25, twice a quantity added to a quantity is given equal to 9 and the quantity is found to be 3. In 19, 1 ½ times a quantity is added to the quantity to give 10 and the quantity is found to be 4. The various steps here are equivalent to the following: $1\frac{1}{2}x + 4 = 10$; $10 - 4 = 6$; $1\frac{1}{2}x = 6$; $x = 2/3 \cdot 6 = 4 = x$. In problem 1, as reconstructed by STRUVE, we have something new in problems of this character: a quantity diminished by 1/5 of the quantity is equal to 20; what is the quantity? In all earlier known problems of this kind, no portion of a quantity was ever subtracted from other portions. It is by no means certain that we have such an exceptional problem here. Problems of this group in the Rhind papyrus are of far greater interest.

Except possibly for problem 18, the remaining seven problems (4, 6, 7, 10, 14, 17, 18) are geometrical and have to do with plane areas, the area of a curved surface and a volume. STRUVE surmises that problem 18 may be simply: To find the area of a rectangle whose sides have lengths 5 *ells* 5 *spans*, and 2 *spans*. [The result is 80 square spans since there are 7 *spans* to an *ell*.]

In Problem 6 there is no uncertainty, and the solution of the following problem is indicated: Given that the area of a rectangular enclosure is 12 *arurae*, and that its breadth is 3/4 of the length, find the length and breadth (8). Looked at from the point of view of modern algebraic symbolism, it might be said that the solution of this problem was equivalent to solving the simultaneous equations $xy = 12$ and $x : y = 3 : 4$. Exactly these same equations may be similarly reached in consideration of a problem of the Kahun papyri, which are of the same period as the Golenishchev papyrus. See the notes on GRIFFITH (1897) in my Bibliography where I note also the equations $x : y = 1 : 3/4$, $x^2 + y^2 = 100$ suggested by SCHACK-SCHACKENBURG in connection with a problem of Berlin

(8) STRUVE believes that this problem makes clear that the Egyptian had the conception of a proportion such as $a : b = c : d$, which PEET has denied (Rhind Papyrus, p. 60).

papyrus 6619. To state that the ancient Egyptians solved simple equations, and simultaneous quadratic equations carries with it implications which can, I believe, be exaggerated. In this regard, Professor STRUVE and I do not seem to be in entire agreement.

In Problems 4, 7, and 17 triangular areas are considered. Problem 4 is in fragmentary condition but enough of the writing remains to show that it is identical with problem 51 of the Rhind papyrus concerning which there has been so much discussion. Is a right-angled or an isosceles triangle in question here? Did the Egyptian of the Golden Period for things of the spirit believe, as his descendants 1800 years later declared, in the Edfu inscription, that the area of an isosceles triangle is one half the product of the lengths of a side and the base? STRUVE declares himself with conviction: (a) an isosceles triangle is in question here; (b) its area is indicated as one half the product of its base or breadth *(tp.r)* by its altitude or length *(mryt)*.

Problems 7 and 17 are of the same type. The first of these is: A triangle of 20 *arurae* area is such that its perpendicular height is 2 ½ times the base; find both. Problem 17 differs only in stating that its perpendicular height is 2/5 of the base. STRUVE believes that right angled triangles are here in question. PEET and GUNN, in their study of problems 6, 7, 17, 14, to which we have referred above (9), argue with force that scalene triangles may well have been thought of here; indeed the figure of problem 17 suggests this very definitely.

And finally we come to problems 14 and 10 which contain the most extraordinary results in ancient geometry. Problem 14 was the one published by TURAEV in 1917; it seemed to prove that the Egyptian knew how to find the volume of the frustum of a square pyramid since every step is equivalent to substitution in the formula

$$V = (h/3)\,(a^2 + ab + b^2).$$

For results given by HERON OF ALEXANDRIA, MAHĀVĪRĀCĀRYA, AL-KHOWÂRIZMÎ, LEONARDO OF PISA, and others, see my Bibliography.

But a more remarkable result still is contained in problem 10 where every step of the work is equivalent to substitution in the formula for the area of a hemisphere

$$S = [(2d - 2d/9) - (1/9)\,(2d - 2d/9)].d.$$

This may be simplified to give $S = (1/2)\,(256/81)d^2$, 256/81 being the value for π which is used in the Rhind papyrus. In problem 10 the

(9) Dr. KURT VOGEL has just published a study of problem 14 (*Journal of Egyptian Archaeology*, Nov. 1930, v. 16, p. 242-249). This contains a thorough survey of earlier related work, and an interesting new interpretation of the probable manner in which the Egyptian arrived at his result.

value of d is 4 ½ and the value of S is found to be 32. It will be recalled that the area of a circle of diameter d was given in problem 46 of the Rhind papyrus as $[d—(1/9)d]^2$. Here $S = 2\ [d—1/9d]^2$. Why did not the writer of the Golenishchev papyrus make use of this form of the result? Until recently it was supposed that the area of a hemisphere was not discovered till the time of ARCHIMEDES 1600 years later. Students will wait with great interest to learn if the verdict of Egyptologists and mathematicians concerning the interpretation of this problem (10) will be as unanimously favorable as it was in the case of problem 14. At present it seems that the geometrical section of the Golenishchev papyrus is of far greater interest than the corresponding section of the Rhind papyrus.

Professor STRUVE's detailed translation and commentary presented very clearly and enthusiastically, in admirable form and attractive style, occupy pages 41-169. The first 40 pages are taken up with a description of the papyrus under such headings as reconstruction, paleography, orthography, language peculiarities, the stereotype formulas of the problem (for example 22 of them commence with the expression, « example of reckoning »), terminology.

Various concluding discussions occupy pages 170-186. More than a third of this space is devoted to surmises as to the method of discovery of the results for the area of a circle, the volume of the frustum of a square pyramid, the volume and area of a sphere (not very convincing). Professor STRUVE considers that the question as to whether Egyptians developed science for its own sake is absolutely proved by the contents of the Golenishchev mathematical papyrus(11) and the Edwin Smith medical papyrus.

An excellent glossary of Egyptian words is given on pages 187-193, and on the next four pages is a very inadequate name and subject index. Each of the 10 folding plates when opened up extends about 2 feet beyond the printed pages of the text. On these plates are the photographic facsimile of the papyrus and its hieroglyphic transcription. Before using the volume at all the reader will find it convenient to write on the outside of each of the folded plates the numbers of the problems and of the columns of the papyrus treated thereon.

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(10) Papyri, as well as Babylonian tablets, have a tendency to crumble away. It was found that a photograph made of this problem in 1909 contained a suggestion of a sign missing in the photographs of 1922. This photograph is reproduced by STRUVE.

(11) Since writers almost invariably use the term « Rhind mathematical papyrus » in discussing the papyrus in London, and not « London papyrus », would it not be logical to refer to the « Golenishchev mathematical papyrus » rather than to the « Moscow papyrus » as Professor STRUVE does?

Most heartily is Professor STRUVE to be congratulated on the remarkable result of his labors which will be a matter of profound interest to every student of the history of mathematics. He sets forth in extenso his debt for continued stimulus and suggestion on the part of Doctor NEUGEBAUER, notable leader in illuminating the dark places in Babylonian mathematics, who is also to be congratulated on securing for his *Quellen* this extraordinary work.

27 *December*, 1930. R. C. ARCHIBALD.

Paul Tannery (1843-1904). — *Mémoires scientifiques* publiés par J.-L. HEIBERG & H.G. ZEUTHEN. Tome X (Supplément au tome VI). Sciences modernes, généralités historiques 1892-1930. Edité avec la collaboration de JOSEPH PÉRÈS. XVI+498 p. Toulouse, EDOUARD PRIVAT, 1930.

Huit ans après la mort de PAUL TANNERY, Mme TANNERY a commencé la publication de ses mémoires scientifiques, dont les volumes substantiels se sont succédés depuis avec une persistance admirable. Le monument élevé à la mémoire de l'illustre savant grandit d'année en année. Nos lecteurs sont bien placés pour en juger, car nous avons longuement rendu compte de chaque volume. Le premier (1912) fut analysé dans notre premier volume, le neuvième (1929) dans notre quatorzième (p. 426-30).

Le présent volume intéressera surtout les historiens de la science au sens large. Il leur prouvera, s'ils ne le savaient déjà, que TANNERY n'était pas seulement un érudit, mais un penseur et un philosophe. Je n'hésiterai pas à dire qu'il fut vraiment l'apôtre de l'histoire de la science, et dans ce domaine l'héritier direct d'AUGUSTE COMTE. Quelle ironie cruelle que celle qui fit écarter de la « chaire d'histoire générale des sciences au Collège de France » celui qui était le mieux préparé à l'occuper non seulement par son érudition, mais encore par sa conception même de cette discipline nouvelle et l'orientation de son esprit !

La France a donné naissance à deux historiens de tout premier ordre, TANNERY et DUHEM, qui ont été également empêchés d'enseigner à Paris par la toute puissante bêtise administrative.

L'histoire de l'échec de TANNERY en 1903 malgré l'appui du Collège de France et de l'Académie des sciences peut se lire aux p. 143 à 161, et plus loin l'admirable discours d'ouverture (p. 163-191) qu'il se proposait de prononcer. Ce discours et plusieurs autres morceaux publiés dans ce volume peuvent être considérés comme les premières déclarations un peu explicites de nos études.

D'ailleurs TANNERY fit de grands efforts pour organiser l'étude et l'enseignement de l'histoire des sciences en France et à l'étranger. En

1884 il communiquait à ENESTRÖM le plan d'un cours d'histoire des mathématiques; en 1892, il esquissait un cours pour la classe supérieure des lycées; en 1900 il présidait magistralement la section d'histoire des sciences au Congrès international d'histoire de Paris; en 1903 et 1904 il prenait une part active aux Congrès de Rome, de Paris et de Genève. Au Congrès de Rome il proposa l'organisation d'une « Société et d'une Revue d'histoire générale des sciences » (p. 109). La première revue internationale réalisant l'idéal de COMTE et de TANNERY fut la revue *Isis* dont le manifeste étendu parut en 1912, et le premier fascicule en 1913. Il est intéressant à ce sujet de noter l'observation suivante de TANNERY :

« Une telle Revue, pour vivre, a besoin de remplir une des trois conditions suivantes : 1° avoir un caractère international et tenter, comme spéculation, une importante maison de librairie; 2° avoir au contraire un caractère national et obtenir, par suite, les subventions d'un gouvernement; 3° être l'organe d'une Société qui en ferait les frais. » (p. 110).

La revue *Isis* fut absolument internationale dès le début, mais il fut impossible d'obtenir le concours d'aucune importante maison de librairie; elle n'obtint aucune subvention gouvernementale, et ne devint l'organe d'une Société, créée ad hoc, qu'en 1924, douze ans après sa fondation.

En dehors des documents déjà cités et d'autres du même genre, le volume dix des mémoires contient :

Quatre longues notes sur l'histoire des mathématiques, de la géométrie, de la mécanique, et de l'astronomie, auxquelles les historiens de ces sciences devront toujours se reporter (p. 15-101).

Les sociétés savantes et l'histoire des sciences. Parmi les travaux dont TANNERY recommandait en 1904 l'entreprise aux savants de province, je note l'édition de la correspondance du Père MARIN MERSENNE (3 vols. in folio de lettres addressées au Minime, MSS. Bibliothèque nationale, Paris). Je suis heureux de pouvoir annoncer que grâce au dévouement de M. C. DE WAARD et surtout de MME. TANNERY, la préparation de cette édition se continue. Sa publication sera une contribution importante à l'étude des sciences dans la première moitié du XVII^e siècle.

AUGUSTE COMTE et l'histoire des sciences (*Revue générale des sciences*, 410-17, 1905). Excellente étude que les admirateurs de COMTE, aussi bien que ceux de TANNERY, feront bien de lire ou de relire.

Programme d'une histoire générale des sciences.

Une bonne partie du volume (p. 255-429) reproduit les nombreuses notes communiquées à *Bibliotheca Mathematica* sous forme de réponses aux questions d'ENESTRÖM ou de corrections aux *Vorlesungen* de CANTOR, et à l'*Intermédiaire des mathématiciens*. Il est assez difficile de les lire, mais l'index permettra d'y recourir aisément.

Le reste concerne des lettres addressées à MERSENNE par CAVALIERI, CAMPANELLA, RENERI, et par des correspondants bordelais : PIERRE TRICHET, J. LACOMBE, AUBERT, FRANÇOIS DU VERDUS, THOMAS MARTEL.

Une liste des chapitres contribués par TANNERY à l'*Histoire générale* de LAVISSE ET RAMBAUD, sera fort utile. Ces chapitres constituent une petite histoire des sciences en Europe depuis le XIV^e^ siècle jusqu'à 1900. Il serait désirable qu'ils fussent publiés séparément.

31.02.08. GEORGE SARTON.

Benjamin Ginzburg. — *The adventure of science.* XVI+487 p., 8 portaits. New York, SIMON and SCHUSTER, 1930 ($ 5).

The progress of science is the theme of this work. Philosophers discuss it. Scientists settle the argument by providing a concrete illustration of it. Our author dramatizes the process by portraitures of the succession of star actors in the performance from PYTHAGORAS to EINSTEIN.

The book is the outcome of a course of lectures in the New School for Social Research in New York City. It is reminiscent of the environment, the audiences to whom it was presented, and the previous journalistic training and experience of the author on the *Chicago Tribune*, the *International News Service*, and the *Encyclopedia of Social Sciences*.

The material is assembled in sixteen chapters grouped about prominent characters representing schools or periods of thought, or outstanding personal achievement. The selections are skilfully made. They include PYTHAGORAS, ARISTOTLE, ARCHIMEDES and PTOLEMY, COPERNICUS, GALILEO, HARVEY, NEWTON, LAVOISIER, DALTON, FARADAY and MAXWELL, HELMHOLTZ, LAMARCK and DARWIN, PASTEUR, MENDEL, and EINSTEIN. In the closing chapter the biographical method is abandoned and the atom with the quantum theory replace the human actors in the drama of the progress of science across fifteen centuries of intellectual activity.

The chapters are written in the free and easy style of the popular lecturer, in which surveyors are « rope-stretchers » and church music « religious catharsis. » By such means he invites the casual reader's interest and doubtless carries it along through the details, mathematical, philosophical, and historical, assembled for the dramatic presentation of rather concrete and often uninviting details. This is interlarded with relapses into an argumentative style, as when ARISTOTLE's conceptions of sex determination and general heredity are summed up as a derogation of the place of the female and are cited as a reflection of the human prejudices of the day. Then the attack is diverted to the Nordic brand of anthropology and the abominations of paraded racial superiority.

History repeats itself. The philosophy of LAMARCK wrought out in the atmosphere of the French Revolution sought the factors of evolution

in the direct action of the environment, and the inheritance of the effects of use and disuse. Moscow recently called the modern would-be demonstrator of the inheritance of acquired characters to head its new Institute of Genetics. The collapse of his evidence under critical scrutiny was as dramatic as the sad exit of the misled investigator from the stage. In the chapter on LAMARCK and DARWIN our Lecturer at the New School of Social Science seeks again to rehabilitate Lamarckianism into respectable biological or at least philosophical society. This is done in the face of a great body of solid scientific experimental work; of all of the trend of genetic studies; of experimentally induced mutations; and of the critical attacks upon GUYER's reports of the inheritance of the effect of the injection of eye lens substance in rabbits. It is perhaps safe and also sound to say that all serious efforts to find evidence for the inheritance of acquired characters have thus far failed and that at the least a Scotch verdict of not proven must in all fairness be rendered.

Some carelessness has crept into the work; thus on p. 14, « circular » is used for spherical; on p. 27, « Asclepead » for ASCLEPIAD; on p. 28, « vocation » for call; on p. 29, « naturalistic specimens » for natural history specimens; on p. 32, « situate » for place; on p. 297 we find « nature red *with* tooth and claw » ; and throughout Chapter 12 WEISMANN is habitually misspelled.

December 10, 1930. CHARLES A. KOFOID.

James Mackaye. —*The Dynamic Universe.* x+308 p. CHARLES SCRIBNER's Sons, New York, 1931. (Price $ 3.50).

The book under review was written with two purposes, first to make a critical appraisement of the postulates of relativity and, second, to suggest a theory of « universal radiation » as a solution of the paradoxes of modern physics, particularly as they appear in the metaphysics of relativity.

The constructive philosophy of the book consists in the suggestion that space is filled with an ethereal radiation from the properties and activities of which all physical phenomena can be explained. Gravitation, for example, is to be derived from the difference between a postulated « G-radiation », absorbed by « *materions* », the unitary particles of matter, and an « I-radiation » re-emitted by the materions. The author admits that the theory as presented is incomplete and has not been formulated by him in mathematical language.

As one immediately perceives and as the author states, this theory is essentially the same as the modern version of the postulate advanced by GEORGES-LOUIS LESAGE (1724-1803) in 1747 to explain the theory of gravitation. That this theory is not without its attraction can be seen from the fact that a memoir in which the Lesagian postulate was

developed was crowned by the Academy of Rouen in 1758. In its completed form the theory was published in the transactions of the Royal Academy of Berlin in 1782 under the title : « Lucrèce Newtonien », and attained considerable prominence among scientists of that day. Since then it has received the serious attention of such eminent physicists as CLERK MAXWELL, LORD KELVIN, H. A. LORENTZ, GEORGE DARWIN, and HENRI POINCARÉ. It is unfortunate that the author did not survey or at least mention the results of these investigations in order that the reader might be instructed as to the present status of the Lesagian theory.

A word of explanation concerning the postulate of LESAGE is perhaps necessary here. This ingenious theory assumed that space is filled with a huge swarm of « ultramundane corpuscles » of very minute size moving in all directions. An object placed in such a sea of corpuscles would naturally remain at rest because as many particles would strike it on one side as upon the other and there would not be a pressure differential to create motion. It would be otherwise, however, with two bodies immersed in such a « gravitational fluid » because each would screen off some of the corpuscles from the other and the difference in pressure that would thus result would tend to drive the two objects together. Moreover, it is possible to show that the impelling force would vary inversely as the square of the distance between the two bodies under various assumptions as to the elasticity of the particles, the density of the fluid, etc. If then, we change the corpuscles into sources of radiation and replace the pressure of impact with the pressure of radiation we have the theory of LESAGE in its modern guise.

It is very difficult in a book written without the use of mathematics to determine the exact nature of the postulates assumed, but in so far as the reviewer can discover there is a very close if not a complete correspondence between the radiation form of the LESAGE theory and that advanced by Professor MACKAYE. If this is the case then grave difficulties have been urged against the theory. The author expresses a measure of surprise that LORENTZ, while presenting the mathematical theory of the radiation postulate in his « Lectures on Theoretical Physics », gives it brief attention. The reason for this is to be found in the inability of LORENTZ to account for the disappearance of the heat which must inevitably be generated as a consequence of the difference between the G and I-radiations. We quote the following pertinent remark of POINCARÉ : (*Science and Method*, The Foundations of Science, Science Press, 1921, p. 521).

« Therefore there can not be attraction without absorption of light and, consequently, without production of heat, and this it is which determined LORENTZ to abandon this theory, which, at bottom, does

not differ from that of LESAGE-MAXWELL-BARTHOLI. He would have been much more dismayed still if he had pushed the calculation to the end. He would have found that the temperature of the earth would have to increase 10^{13} degrees a second ».

It is a pity that this stubborn difficulty still confronts the Lesagian theory, because it is not without its appeal as we have already pointed out in the eminent men who have given it more than casual attention. The curious reader will find an historical discussion of the theory in « Kinetic Theories of Gravitation » by W. B. TAYLOR, *Smithsonian Report* for 1876, pp. 205-282, in particular p. 217 et seq., the mathematical theory in « An Analogy between LESAGE's Theory of Gravitation and the Repulsion of Light », by GEORGE DARWIN, *Proceedings of the Royal Society*, vol. 76 (1905), A, pp. 387-410, also *Scientific Papers*, vol. 4, No. 21, Cambridge, 1911, the radiation theory in « Considerations on Gravitation » by H. A. LORENTZ, *Proceedings of the Royal Academy* of Amsterdam, vol. 2 (1900), pp. 559-574, and a statement of the difficulties of the theory in the discussion of POINCARÉ previously mentioned.

It is interesting to note in this same connection that the author asks the question whether gravitation is an evidence of the long-sought longitudinal component of radiation, although in this he was anticipated by T. TOMMASINA who suggested in 1909 that radiation pressure may be an evidence of this elusive component. (*Comptes Rendus*, vol. 149 (2), 1909, pp. 627-629).

In making his criticism of the theory of relativity the author did not attempt seriously to impeach either the experimental evidence or the mathematical theory. He laid some stress on recent criticism of the experimental basis of the crucial experiments and paid special attention to the phenomenon of anomalous dispersion where the fractional value of the index of refraction in certain metalic gases gives evidence of the existence of a velocity exceeding that of light in vacuo. He also expressed dissatisfaction with various cosmological consequences which have followed from the attempts of EINSTEIN and DE SITTER to explain the existence of an absolute rotation.

The real objection of the author to the theory of relativity, however, resides in what he considers to be its « verbal confusion » and its paradoxes. « The philosophy of relativity is a union of physics and metaphysics, combining truth and untruth in a manner qualified to obscure the cosmic clue contained in the equations of relativity ». In reality the author represents the feeling of not an inconsiderable number of physicists both past and present that nature must be explained in terms of models; that present tendencies to replace an appeal to natural intuitions by

a set of abstract postulates, usually mathematical in formulation but always consistent with physical experience, are unsatisfactory. Radiation in an ether, wraithlike though it may be, seems preferable to some to the subjective postulates of DIRAC, HEISENBERG and SCHRÖDINGER. POINCARÉ has more than once commented upon this deep-rooted desire and has made some attempt to show that it has ethnic characteristics. « They (the English) are always to hold, so to speak, one foot in the world of senses, and never burn the bridges keeping them in communication with reality... For a Latin, truth can be expressed only by equations; it must obey laws, simple, logical, symmetric and fitted to satisfy minds in love with mathematical elegance ».

It seems more satisfactory to some scientists to hold to the concept of a quasi-material ether than to replace it by a set of mathematical formulas, in spite of the fact that no set of consistent postulates has ever been constructed which will endow the ether with any of the properties of an elastic material medium except the property of undulation. The author represents this point of view... « I am going to venture to go entirely contrary to the trend of modern speculation about the ether, and not only assume its existence, but assume that it resembles the kind of matter familiar to us even more than has hither-heretofore been suspected ». Unfortunately here one feels again the necessity for a mathematical picture in order that the postulates may be accurately seen and that the author's method of overcoming older difficulties may be learned.

The book itself is clearly written and is replete with citations from competent sources. It represents an honest attack upon a certain kind of verbal obscurity in the theory of relativity which popular accounts have tended to accentuate. The attempt which it makes to replace relativity by a picture that has some intuitional appeal is not without interest in view of the long history of the Lesagian theory both in its corpuscular and later in its radiation form.

(Indiana University). H. T. DAVIS.

Ernst Zinner. — *Die Geschichte der Sternkunde*. Von den ersten Anfängen bis zur Gegenwart. XI+673 p., 54 figs., 13 pl. Berlin, JULIUS SPRINGER, 1931. (RM. 18.60; bound, RM. 21.80).

The defunct Verlag der Münchner Drucke, publishers of a series of monographs devoted to the *Geschichte der Wissenschaften*, announced in 1929 the forthcoming appearance of ZINNER's *Geschichte der Sternkunde*, in 2 vols, ca. 700 pages. The book under review is, no doubt, the result of merging these two volumes into one; part 13 of the SPRINGER edition, *Die Sternkunde der Germanen* (p. 314-608), is obviously the essential

part of the original second volume which may also have contained the last pages (p. 609 ss.) of our book.

The first 12 parts (Teile)—the essential constituents of the original first volume—are devoted to the *Sternkunde* of the Egyptians (32 p.), the Babylonians (37 p.), the Greeks (83 p.), the Romans (8 p.), the Jews (5 p.), the Persians (4 p.), the Indians (29 p.), the Chinese (44 p.), Eastern Asia outside of China (5 p.), *Naturvölker* (14 p.), the Mayas (7 p.), and the Arabs (45 p.). Then comes the already mentioned part 13, *Die Sternkunde der Germanen* (295 p.), followed by the grotesque part 14, *Die Sternkunde der Kelten* (1 p.), and by part 15, *Die Sternkunde der Slaven* (3 p.). Parts 16 and 17 are devoted to *Die Geschichtsschreibung der Sternkunde* (10 p.) and to *Vergleichende Betrachtungen* (14 p.), respectively. Two bibliographies, *Die Literatur zur Geschichte der Sternkunde* (6 p.) and *Lebensbeschreibungen von Gelehrten* (4 p.), and two indexes, a three-column *Personenverzeichnis* (14 p.) and a two-column *Sachverzeichnis* (13 p.) complete this valuable reference-book.

ZINNER's *Geschichte der Sternkunde* will remain—for many years to come—a standard work of reference; it is to be regretted that it will irritate or annoy—for many years to come—European and American readers who do not consider the *Germanen* as the Chosen People.

Thuringia is, as everybody ought to know, the cradle of the better type of humanity :

« Gemäss den Untersuchungen SCHUCHHARDTS (1928) ist der Sitz des indogermanischen Urvolkes in Thüringen zu suchen, dessen Bevölkerung in der jüngeren Steinzeit sich sehr ausdehnte und zur Entstehung des Keltentums in Süddeutschland und des Germanentums in Norddeutschland durch die Vermischung mit der ansässigen Bevölkerung führte; ferner waren die Thüringer hervorragend beteiligt an dem Völkerzug, aus dem die Illyrier, die Griechen und zuletzt die Sanskrit-Inder hervorgingen. » (p. 314).

Thus, the Greeks were, after all, « made in Germany », and this may account for the fact that they are, after the *Germanen*, the only Europeans for whom ZINNER has respect.

A slight admixture of Germanic blood, and a temporary political supremacy of Germanic rulers has not prevented the inhabitants of Western and of Southern Europe from developing a set of distinctly non-Germanic civilizations. To ignore the very existence of these civilizations, whatever the relative importance of their contributions to astronomy may be, is a state of mind highly unsuitable for a historian of science. The use of the word « Germanic » instead of « mediaeval » or « Christian » or « European » would be less objectionable if a confusion with its legitimate meaning could be avoided; unfortunately, ZINNER's abuse of the terms *Germanen* and *germanisch* is the result of his sincere

belief that the cultural history of Christian Europe is a hymn ad maiorem Germanorum gloriam.

« Mit der Einnahme Konstantinopels im Jahre 1453 verlor die Sternkunde auf griechischem Boden ihren letzten Halt. Zur selben Zeit führte die Kenntnis der wichtigsten Schriften des griechischen Geisteslebens zur Belebung der germanischen Wissenschaft, die sehr bald die Schwächen ihrer Vorbilder erkennend neue Wege einschlägt. » (p. 152).

« Bedeutungsvoll war die Tätigkeit der Juden als Uebersetzer. Sie haben verschiedene Werke ins Arabische übersetzt und dadurch den Arabern übermittelt. Nicht minder bedeutsam war ihre Uebersetzertätigkeit vom 11.-13. Jahrhundert, wo sie verschiedene Werke den Germanen zugänglich machten. » (p. 165).

« Eine rege Uebersetzertätigkeit setzte erst im 15. Jahrhundert ein, als infolge der Einnahme Konstantinopels durch die Türken griechische Handschriften nach Europa kamen und damit die Germanen die Gelegenheit erhielten, die Ueberlegenheit des griechischen Wissens über das arabische kennenzulernen. » (p. 331).

All roads lead to Thuringia.

Part 13, *Die Sternkunde der Germanen*, consists of three chapters : *Die ursprüngliche Sternkunde der Germanen* (5 p.); *Die Zeit der Aneignung fremden Wissens* (87 p.); and *Die neue Zeit* (201 p.). The first chapter gives, in spite of ZINNER's efforts, the impression that the starlore of the German barbarians was just as primitive and crude as the starlore of the Celtic and Slavic savages who lived under the same cloudy sky. The second chapter gives, in spite of the Thuringian color-filter, a satisfactory view of the slow process of assimilation of imported cultural goods during the Middle Ages. The third chapter is a book of two hundred pages dealing with the history of astronomy since the Renaissance. Mathematics, geodesy, etc., are given due consideration. The contributions of the CASSINI dynasty, of GALILEO, LACAILLE, LAGRANGE, LALANDE, LAPLACE, LEVERRIER, MARALDI, MAUPERTUIS, NOVARA, PIAZZI, PICARD, POINCARÉ, SCHIAPARELLI, SECCHI—and of many others—to the *Sternkunde der Germanen* are duly acknowledged. The account of the work of American astronomers and astrophysicists is quite satisfactory.

Part 4, *Die Sternkunde der Römer*, reflects ZINNER's condescension toward the unworthy ancestors of the people who were promoted to the rank of *Germanen*, when the Vandals and the Lombards toured Italy.

« Die Erforschung der Erdoberfläche wurde nur aus praktischen Gesichtspunkten heraus betrieben. Zum Kriegführen waren gute Strassen und Meilenkarten wichtig. Dazu dienten die Kenntnisse der Feldmesser, ohne viele wissenschaftliche Zutaten. Die Strassen und Brücken der Römer sind recht gute Werke. Auch die römische Strassenkarte war keine schlechte Leistung. » (p. 156).

« Für die Erdmessung und für die Untersuchung der Gestalt der Erde fehlte den Römern jegliches Verständnis. Dagegen erschien ihnen eine Reichsvermessung nötig, um möglichst viele Steuern zu erpressen. AUGUSTUS liess eine solche Messung durch 4 Griechen ausführen. » (p. 156).

« Wichtiger für Reisen waren tragbare Sonnenuhren. Von ihnen sind verschiedene Stücke, besonders aus der römischen Kaiserzeit des 2. Jahrhunderts nach Chr., gefunden. Ihre Einrichtung ist wohl kaum römische Erfindung, vielmehr griechische unter Benützung von ägyptischen Vorbildern. In ihrer Ausführung sind sie nicht schlecht. » (p. 155).

« Gegenwärtig gibt es von den meisten griechischen Werken lateinische Uebersetzungen. Daraus darf man nicht schliessen, dass diese Uebersetzungen im Altertum gemacht worden sind, um die Römer mit dem griechischen Geistesleben bekannt zu machen. Solche Absichten lagen den Römern völlig fern. Für sie war die Wissenschaft nur insofern wertvoll, als sie unmittelbaren Nutzen versprach. » (p. 160).

« Die Sternkunde diente den Römern nicht zur Stählung des Geistes und zur Befriedigung ihres Forschungsdranges, sondern nur zur Erhöhung ihrer Macht und zur Befriedigung des abergläubischen Volkes, bestenfalls zur Ausschmückung ihrer Reden und zur Unterhaltung. » (p. 157).

« Somit endete die grosse Kulturwelle auf römischem Boden : Unwissenheit und Aberglaube auf der einen Seite, unberechtigter Stolz auf eine grosse Vergangenheit auf der anderen Seite. » (p. 160).

Part 12, *Die Sternkunde der Araber*, is also well worth reading.

« Die arabische Kultur stellt die Brücke zwischen Altertum und Neuzeit dar. Allerdings liegt ihre Blüte vor dem 13. Jahrhundert; aber in diese Zeit fällt ihre Vermittlung des Wissens des Altertums an die damals besonders lernbegierigen und aufnahmefähigen Germanen, und dadurch hat die arabische Kultur eine grössere Bedeutung erlangt, als es sonst wohl geschehen wäre. » (p. 269).

« Eine Schilderung der arabischen Mathematik kommt hier nicht in Betracht. Vielmehr soll hier nur insoweit davon die Rede sein, als die arabische Mathematik zur Entwicklung der Sternkunde bei den Arabern oder bei den Germanen beigetragen hat. » (p. 273).

In spite of this utilitarian point of view—which reminds one, incidentally, of the objectionable attitude of the Romans toward Greek *Geistesleben* and *Geistesschätze*—ZINNER gives a rather complete account of the *Sternkunde* of the Arabs. His opinion concerning their achievements will be quoted later.

Parts 7 and 8, devoted to India and China, seem to be as well written as the first three parts dealing with Egypt, Babylonia, and Greece. Each part is divided in chapters on *Die Erfassung der Zeit, die Erfassung des Raumes*, *Sternglaube und Sterndeutung*, and on *Gelehrte*, *Unterricht*, *Geräte (Instrumente) und Sternwarten*.

Part 10 gives very interesting short accounts on the *Sternkunde* of the American Indians, and of the inhabitants of the South Sea Islands, of Australia, of Africa, and of the Arctic.

Part 17, *Vergleichende Betrachtungen*, deserves to be quoted at length.

« Die Geschichte der Sternkunde kann sich nicht darauf beschränken, den Werdegang der Sternkunde mit ihren Auswirkungen auf die Erfassung des Raumes

und der Zeit, in der Herstellung von Geräten und in der Sterndeutung bei den verschiedenen Völkern zu schildern, sondern sie muss auch versuchen, gewisse Eigentümlichkeiten in ihrem Werdegang in Beziehung zueinander zu bringen und dadurch einen Beitrag zur Geistesgeschichte der Menschheit zu liefern. » (p. 623).

Unfortunately, the Thuringian point of view is responsible for a bias which detracts considerably from the value of ZINNER's « comparative considerations ».

« In höheren Breiten erfolgte bei den Germanen eine nicht dem Sonnenstande, sondern dem Wetter entsprechende Jahresteilung und die Verdrängung der Monate durch die siebentägige Woche. Später haben die Germanen die Fortführung der Sternkunde übernommen und trotz der Ungunst des Wetters an ihren Wohnsitzen in wenigen Jahrhunderten mehr Geheimnisse dem Himmel abgerungen als ihre Vorgänger in Jahrtausenden. » (p. 624-25).

« Nicht jedes Volk hat eigene Denkformen zur geistigen Verarbeitung der himmlischen Vorgänge erfunden. Vielmehr ist eine Weiter- oder Ausbildung der Sternkunde nur bei wenigen Völkern zu finden. Mit einer solchen Ausbildung pflegt auch eine entsprechende Weiterbildung der anderen Wissenschaften und damit der Kultur eines Volkes einherzugehen. Aus der geschichtlichen Betrachtung der Sternkunde ergibt sich dabei ein Massstab für den zeitlichen Umfang und die Stärke solcher Kulturen. So lässt sich die Erfassung der Vorgänge am Himmel als Massstab anwenden : Manche Völker geben sich mit einer Annäherung zufrieden. Hochstehende Völker zeigten aber immer das Bestreben, auch über die Bedürfnisse des täglichen Lebens hinaus die Wirklichkeit zu erkennen und rechnerisch darzustellen. Nur bei den Griechen und Germanen liegen Tatsachen vor, welche erkennen lassen, inwieweit die beabsichtigte Annäherung an die Wirklichkeit geglückt ist. » (p. 625-26).

The curves of Figs. 53 and 54, based on physiology and psychology — the *Leistungskurve der Germanen* climbs a logarithmic scale of ordinates— are used to prove that the *Germanen* are smarter than the Greeks :

« Die Kurve (Bild 54 auf S. 596) dieser Entwicklung der Sternkunde erinnert an die für die Arbeitsfähigkeit des Auges gefundene Kurve (Bild 53 links). Der Vergröberung der Arbeitsfähigkeit des Auges beim Arbeiten ausserhalb des bequemen Bereiches entspricht für das Griechentum die Abweichung von der Wirklichkeit für die Zeit vom 5.-3. vorchristlichen Jahrhundert und vom 2.-14. nachchristlichen Jahrhundert. Wie sich der Mensch der zunehmenden Ungenauigkeit seiner Beobachtungen nicht bewusst wird, so wird das Griechentum jederzeit überzeugt gewesen sein, mit seinem Streben der Wirklichkeit so nah wie möglich zu kommen. So wusste PTOLEMAIOS sicherlich nicht, dass er die Bewegung der Sonne schlechter als HIPPARCH kannte. Da diese beiden Kurven auch der menschlichen Leistungskurve (Bild 54, I), wo die grösste Annäherung an die Wirklichkeit dem Mannesalter entspricht, ähneln, so ist die wissenschaftliche Leistung einer Kultur, sofern sie sich über den blossen Nutzen erhebt, der Leistung eines Menschen vergleichbar. Aehnlich steht es mit den wissenschaftlichen Leistungen der Germanen. Zu der Zeit, wo die Griechen durch die Uebernahme fremder Tafeln den Verzicht auf eine eigene Sternforschung kundgaben, machte

sich das Emporsteigen der germanischen Sternkunde durch die Uebernahme und Umarbeitung fremder Bewegungstafeln bemerkbar, worauf bereits im 14. Jahrhundert die Ueberflügelung der gleichzeitigen griechischen und im 16. Jahrhundert die Ueberbietung (Bild 54, III) der besten Leistungen der griechischen Sternkunde erfolgte und bis jetzt eine um das 3000fache grössere Annäherung an die Wirklichkeit (Bild 54) erreicht worden ist, in Uebereinstimmung mit einer gleichgrossen Verfeinerung der Teilung der Zeit und der Geräte. Im Zusammenhang mit diesem Gegensatz der germanischen und griechischen Leistungen steht die Verschiedenheit der Kurven der griechischen und germanischen Arbeitsfähigkeit des Auges. » (p. 626-27).

We thus have a mathematical proof that the *Germanen* are smarter than the Greeks. The Gregorian calendar reform is used as a proof of the « greater sensibility of the *Germanen* for celestial influences ».

« Wie die Annäherung an die Wirklichkeit einen guten Wertmesser zur Beurteilung der Höchstleistungen eines Volkes darstellt, so lässt sich aus der Anpassung der Zeitrechnung an die Wirklichkeit ein Schluss auf die geistige Anpassung des Gesamtvolkes machen... Ueber die Jahreslänge von 365 1/4 Tagen, welche auch der ägyptischen Neuordnung von 239 v. Chr. zugrunde lag, kam das Altertum indessen nicht hinaus, weshalb diese Jahreslänge durch die christliche Kirche den Slaven und Germanen übermittelt wurde. Während die allmähliche Verschiebung der Feste gegen die Jahrespunkte bei den Süd- und Ost-Slaven nicht sehr beachtet wurde und eine Neuordnung der Zeitrechnung erst in der letzten Zeit gegen den Willen der Priester erfolgte, missfiel den Germanen die Nichtübereinstimmung zwischen Kalenderrechnung und Wirklichkeit... Auch hier zeigt sich eine grössere Empfindlichkeit der Germanen für die himmlischen Einflüsse » (p. 627).

One more quotation from the « comparative considerations », to show ZINNER's opinion of the Arabs :

« Aehnlich steht es mit den Arabern, den bedeutendsten der geistigen Erben der griechischen Kultur. Auch hier nur Flickwerk. Wohl führt eine verfeinerte Beobachtungskunst zur besseren Kenntnis der Sonnenbahn, jedoch fehlt der Wille zu einer gründlichen Umgestaltung der Bewegungslehre. Ebenso steht es mit der Prüfung des Sternverzeichnisses des PTOLEMAIOS durch AL-SŪFĪ. Die Geräte weisen manche neue Gedanken auf : die Mauerquadranten und die drehbaren Dreistäbe und Quadranten, auch der Kompass und die Sonnenuhr mit Polstab; jedoch fehlt der Wille, mit diesen Werkzeugen etwas Neues zu schaffen. Das geistige Leben ist blutleer : viel Spielerei, viel Mathematik, viel Rechnen, viel Auslegen der Bewegungsschriften, viel Geschwätz, aber wenig Beobachtungen ! » (p. 634).

In the reviewer's opinion, ZINNER did an excellent piece of work by patiently assembling and carefully arranging and indexing the data essential for the writing of a general history of astronomy; the result of this labor is a very valuable reference-book; it could become a *Geschichte der Sternkunde*, if the author were able to throw away his Thuringian

color-filter : he might discover some unsuspected threads and patterns in the age-cold fabric.

It is amusing to see, in the titles, the words *Instrumente*, *Planetarien*, and *Ephemeriden* added in parentheses to the 100 % pure words *Geräte*, *Bewegungsgeräte*, and *Jahrbücher ;* it is a surprise to see the word *Fayence* in a sentence like « Die Sonnenuhren... aus der griechischen Zeit (bestanden) aus Fayance mit Metalleinlage » (p. 32), where *Tonerde* or a similar 100 % pure word would be more appropriate. Names like HEWELKE, KOPPERNICK, KREBS, KREMER, MÜLLER VON KÖNIGSBERG, SCHWARZERD, etc. bear no traces of Latin or Greek degradation.

The book is very carefully proofread; there are a few mistakes which can be traced back to the manuscript. Thus, BARNARD's name is misspelled twice, p. 519 and 534; S. B. NICHOLSON's name is misspelled twice, p. 519 and 656, his initials in the index are wrong. Some references to illustrations hang in the air—the SPRINGER edition has but 54 figures and 13 plates, as compared with the ca. 100 illustrations announced for the two-volume edition.

A. POGO.

Franz M. Feldhaus. — *Die Technik der Antike und des Mittelalters.* (Museum der Weltgeschichte. Die staatliche, wirtschaftliche, soziale, geistige und kulturelle Entwicklung der Völker in Einzeldarstellungen. Herausgegeben von PAUL HERRE.) 442 p., 452 ill., 15 pl. Potsdam, Athenaion, 1931.

As Dr. FELDHAUS is the leading historian of technology of our time one turns to his new book with more than ordinary curiosity. It is divided into four parts : prehistory, ancient orient, classical antiquity, and Middle Ages. The first part is a summary of our knowledge of prehistoric and primitive technology in 35 pages. The second deals with the Far East, India, the Near East, and Egypt in 81 p. In spite of what the title says, it is not restricted to the ancient times : the East is assumed as usual to be unchanging; no serious attempt is made to determine the chronological layers of eastern cultures. To be sure this would be very difficult, but not impossible, and whatever could be done should be done. In that respect the author is on the same level as ABEL REY in his recent work « La science orientale avant les Grecs » (Paris, Renaissance du livre, 1930) wherein pre-Hellenic and post-Hellenic elements are mixed up in such a manner that almost every conclusion is blurred. I must add however that FELDHAUS carefully quotes the dates of the documents mentioned by him whenever possible; he is far less rhetorical and more accurate than REY. The third part, devoted to classical antiquity, covers 102 p.; and it is amazing how much solid

information has been crammed into them. It is true the text is closely printed (about 600 words to the page) but on the other hand the illustrations are so abundant, (about one to a page), that the space reserved for it is much reduced.

The fourth and last part, on mediaeval technology, is by far the longest, the newest and the most important. It covers 207 p., that is, almost half of the work. This is in itself a remarkable innovation, for thus far most historians of science have disposed of the Middle Ages in the most casual manner. This mediaeval part is itself divided into three sections : the early Middle Ages from the Vth to the XIth century, the high Middle Ages, c. 1100 to c. 1250, the later Middle Ages, from c. 1250 to LEONARDO DA VINCI. The first and second section cover about 40 p. each; the third is three times longer than either, but it encroaches already upon the Italian Renaissance.

One could not be too grateful to the author for his patient examination of mediaeval documents, especially the iconographic ones, many of which were novel to me. The author has used archaeological materials far more extensively than any other writer on the subject. The illustrations are exceedingly numerous (452 in the text plus 15 plates, some of which are in color) and most of them cleverly chosen. Many of these illustrations tell their own story, and tell it very effectively. One has almost the feeling that the book was built around the illustrations.

The only shortcoming of this work, and it is unfortunately a grave one, is the lack of references. It is true the author gives a brief list of sources on p. 426-27, and he adds—presumably with his tongue in his check—« Wer für einzelne Angaben die Quellen zu wissen wünscht, der schreibe mir » ! What would FELDHAUS have done if the authors whom he used had taken the same attitude? It is probable that the suppression of references was exacted by the editor; it is not our business to investigate that matter, but simply to consider and judge the book as it is. If my memory does not deceive me, FELDHAUS himself judged LUDWIG DARMSTAEDTER's *Handbuch* very severely because the references had been left out; he cannot complain if the same judgment is applied to him. In a way every reader is cheated by that policy, but none as deeply as the author himself. Indeed it robs this work of the authority it would have so well deserved otherwise. It will be as unwise to quote from it as to quote from DARMSTAEDTER's *Handbuch*. The more the pity.

The book was got up splendidly; in fact it is one of the most beautiful books of its kind that I have come across. If it is bound to disappoint scholars, on the other hand it will delight a good many other readers old and young, and it may inoculate some of the latter with the wish to become historians of science !

I hope the second volume to be devoted to modern technology will not be delayed too long.

31.01.09 GEORGE SARTON.

L. O. Howard. — *A history of applied entomology* (somewhat anecdotal). VIII+564 p. With 51 plates. (*Smithsonian miscellaneous collections*, vol. 84). Washington, 1930.

It is very curious that for more than fifteen years I never received a book on the history of entomology, and that within the last two I had occasion to review three important ones : (1) F. S. BODENHEIMER : *Materialien zur Geschichte der Entomologie* (2 vols., Berlin, 1928-29; *Isis*, 13, 388-92; 14, 454-56); (2) A. C. OUDEMANS : *Kritisch-historisch overzicht der acarologie* (2 vols., 's-Gravenhage, 1926, Amsterdam, 1929; *Isis*, 15, 381-86); (3) the present volume. These three works are equally important yet extremely different. In fact they represent three kinds of historical writing. The first comes nearest to history proper. It is an anthology of the entomological writings of the past down to the middle of the eighteenth century, with biographical and critical notes. The second is more like the sort of historical work which is a natural by-product of taxonomy, but on gigantic scale : what is historically the correct name of this animal or group of animals ? The third is a good example of annals largely based upon personal experience.

The form of Dr. HOWARD's book was natural enough considering the nature of his subject. What we call « economic entomology », and the English (French and German) more comprehensively, « applied entomology » (entomologie appliquée, angewandte Entomologie), is indeed a very young discipline. To be sure it is possible to find traces of it in ancient and mediaeval times, but not much more. The first chapter of BODENHEIMER's second volume (p. 1-78) is devoted to pre-Linnaean applied entomology, but it includes five sections : agricultural entomology, locust years, apiculture, sericulture, vermin (Ungeziefer). Of course if one takes apiculture and sericulture into consideration, the history of applied entomology is considerably lengthened, but HOWARD was mainly concerned with the negative kind of applied entomology : not how to guide the beneficent activities of insects (bees or silkworms), but rather how to check their maleficent activities, and this is a relatively late development. In fact for a long time American entomologists were prone to think of it as a purely American development; what with BODENHEIMER's and HOWARD's books and what with the quarterly reminder of the Review of applied entomology they know better now. The earliest papers or books specifically devoted to it (leaving apiculture and sericulture out) were :

ABRAHAM FRIEDRICH KRAFFTEN : *Von der grausamen Thiere schädlichen Ungeziefers und verderblichen Würmer Natur, Eigenschaft und Ausrottung* (Nürnberg, 1712). Two other titles quoted in HERMANN AUGUST HAGEN : *Bibliotheca entomologica* (vol. 1, 1862, 436).

JOHN SOUTHALL : *Treatise of buggs* (London, 1730). Translated into German (Hamburg, 1737; Berlin, 1842).

LINNAEUS : *Noxa insectorum* (Stockholm, 1752).

To these early writers must be added RÉAUMUR whose *Mémoires pour servir à l'histoire des insectes* appeared from 1734 to 1742. Even if no paper of his is specifically devoted to applied entomology, his whole work is full of pertinent remarks relative to it, and among early writers he is the one who would most deserve to be called the father of applied entomology.

Bearing these restrictions in mind one can say that studies on the subject remained sporadic until the nineteenth century. Nor did the subject receive much attention during the first half of that century. A great change came with the phylloxera epidemic in the seventies and the eighties. One might say that the phylloxera rang an alarm bell across Europe. This was indeed a catastrophe of the first order. By 1884 the total loss to France alone amounted to ten billion francs, two billion dollars. (p. 212-16, 238).

Four other landmarks may briefly be quoted : the discovery of the gipsy moth in Massachusetts in 1889; the discovery of the San José scale in the East in 1893; the discovery of the Mexican cotton boll weevil in Texas in 1894; the discovery by Sir RONALD ROSS in 1898 of the carriage of malaria by Anopheles (p. 115-34).

The main division of HOWARD's history is by countries, a division which is more defensible in this case than in others, because so much of the work is done under the direct supervision of the states.

The largest part of the book is devoted to the United States (182 p.) and this again is legitimate, first because the share of that country was by far the greatest, second because the author knows that part of the story best. It is his privilege as an annalist to tell us what he knows as he pleases. Sections of various lengths deal with the other nations, practically every civilized nation of the world being reviewed.

A few notes on medical entomology, and a history of the efforts made in various countries to use predatory and parasitic insects as allies against our insect enemies constitute a final part (p. 465-532). Readers should be warned to refer to that part if they want to know what the author has to say about each country.

The concluding pages contain a very interesting statistical comparison of the efforts of the leading countries which I beg leave to reproduce

(p. 542). It is based upon the very full bibliography published in the (English) *Review of applied entomology*. During the period extending from the close of 1915 to September 1929, 23430 books and papers were reviewed. The countries having produced more than a hundred each were :

United States	7,311	South Africa	353
Germany	2,029	Hawaii	315
France	1,894	Argentina	219
Russia	1,886	Spain	199
England	1,429	Switzerland	177
Canada	1,135	Egypt	152
India	1,011	Sweden	140
Australia	904	Philippines	136
Italy	699	New Zealand	135
Dutch East Indies	513	Porto Rico	128
Japan	392	Czechoslovakia	121
Brazil	384	Austria	112

It is a pity the author did not add a classification by languages, but the main languages are represented roughly as follows :

English	13,000
German	2,500
French	2,000
Russian	1,886
Italian	699
Others	3,345

The two outstanding facts are the enormous preponderance of the English papers, and the large number of Russian ones. Or to put it in another way, more than half of the books and papers are in English, and three quarters are in English, French or German. This confirms the remarks I made apropos of MAURICE LECAT's bibliography of relativity (Brussels, 1924; *Isis*, 6, 567-68). The multiplicity of languages of which Esperantists make so much, is more apparent than real : a man having a reading knowledge of three languages has access to by far the greatest number and the most important scientific contributions of the world. This is the more true because the authors of important contributions in other languages have generally no rest until their work has been made known to the international world by means of one or more of these three languages.

In the present case the large number of Russian publications is a new factor which is at once very gratifying for the Russians and rather disturbing for the others. Indeed Russian is a difficult language the secrecy of which is increased by a special alphabet. It may be necessary

for the sake of non-Russian readers, to publish annually a thorough analysis of the Russian publications in one of the three international languages, and to translate completely the outstanding ones. This would be a heavy task, but less so than to oblige every entomologist to study Russian !

The author's modesty is disarming. For example, he explains so candidly his unequal treatment of different countries that it would be difficult to bear him any grudge on that score. Says he : « To these [whose work has not been dealt with at sufficient length] I offer humble apologies. I have written hundreds of letters asking for further information; but in some cases I must have chosen my correspondents unfortunately. Perhaps they were dead; perhaps they were ill; perhaps (as is undoubtedly the case with some people) they preferred other kinds of work to letter-writing. One thing, however, is certain : that criticisms of this publication will be printed and that the next historian of economic entomology will have an easier task. » (p. 201). His kindness is equally pleasant; I have not noticed a single unkind remark, though it is hardly conceivable that every entomologist is an angel. May be Dr. HOWARD had unpleasant incidents with his colleagues of many lands in the course of a very long career, but if so, he has forgotten them or he wants his readers to forget them.

I once heard Lord CHARNWOOD (the author of an excellent biography of LINCOLN), tell that when he was still a child he heard so many evil reports of the Tories in his own family circle, that he once asked his grandmother whether the Tories were all born bad or simply became that way. The old lady answered, with a twinkle in her eye, that they were born bad but became worse and worse. One might ask whether Dr. HOWARD was born so kind, or whether his gentleness is a result of old age. I think the correct answer would be in this case also : He was born gentle, and he became gentler and gentler.

Every entomologist should read these reminiscences and will be a better man for having read them. Indeed this book will help to humanize the profession—one of the noblest of professions. In time of war citizens think of the soldiers with gratitude; entomologists are the defenders of mankind in its greatest war—the war against insects. The other wars are incidents, this one never stops. More than once the insects have won, and without the army of entomologists always on the watch, our food supply and our very lives would be in constant jeopardy.

This excellent book is completed by a series of some two hundred and fifty portraits which will give considerable pleasure to many readers. Its only shortcoming, in my opinion, is the lack of an index of the topics

and insects dealt with, but this could be easily remedied in a new edition.

GEORGE SARTON.

Gonçal de Reparaz (Fill). — *Catalunya a les mars. Navegants, mercaders i cartògrafs catalans de l'edat mitjana i del renaixement.* Contribució a l'estudi de la història del comerç i de la navegació de la Mediterrània. Pròleg de GONÇAL DE REPARAZ. 252 p. Barcelona, Mentora, 1930. (In Catalan; the preface is in Spanish).

The preface was written by GONZALO DE REPARAZ (b. in Oporto, 1860); his early essays—written in the late seventies, in Portuguese,—were devoted to the Catalans; his first writings in Spanish—published in Barcelona, in 1880 — dealt with Portuguese navigators and mediaeval cartography. GONZALO DE REPARAZ Junior remained, therefore, true to family traditions when he wrote a book on Catalan navigators and cartographers, and had it published in Barcelona. A translation into Portuguese or Spanish or French was contemplated, when serious difficulties with the publishers arose—but it finally appeared in Catalan; it is not too late to have this interesting and instructive book translated into one of the principal European languages.

Neither a scientific treatise, nor a piece of popular writing, *Catalunya a les mars* is both reliable and readable. The sources are quoted in the numerous footnotes, and a critical bibliography of 57 titles is added. Collections like ANT. CAPMANY SURÍS Y DE MONTPALAU, *Memorias históricas sobre la marina, comercio y artes de la antigua ciudad de Barcelona*, 4 vols., Madrid, 1779-92, and ANT. RUBIÓ I LLUCH, *Documents per la història de la cultura catalana medieval*, 2 vols., Barcelona, 1908-1921, have yielded much of the raw material skillfully utilized by our author.

From the point of view of the history of science, the two most important chapters are : La cultura nàutica i geogràfica dels catalans medievals, and La cartografia i els cartògrafs catalans. The former deals with geography in the middle ages; with science in mediaeval Catalonia (including the Balearic Isles, of course); and with Christian and Jewish Catalan cosmographers. The latter deals with cartography in the middle ages; the Mallorcan school of cartography in the XIVth century; and Catalan cartography until its extinction in the XVIIth century. Much space is, of course, devoted to the CRESQUES, the OLIVES, and the PRUNES; no extravagant claims are made, and the non-Catalan contributions to the advancement of navigation and cartography are discussed in an objective manner.

Of interest to the student of the history of civilization are the chapters devoted to the Catalan marine; to the Catalan commerce; to pirates and

merchants, captives and apostles; to Catalans in the Levant, etc. There is no index, but each chapter is preceded by a short summary, and there is a detailed table of contents.

A. POGO.

John F. Fulton.— *Physiology*. Volume 5 in the *Clio Medica* Series. PAUL B. HOEBER, Inc., New York, 1931. XVI+141 pp., frontispiece and 7 illustrations. $ 1.50

One may doubt whether such a difficult subject could be better handled in such limited space. Certainly it would have been impossible in less. This prompts the suggestion that the books in this significant and provocative series be allowed at least 150 pages, and that the indices be compressed into smaller type. Without question many of the unsatisfactory features of the earlier volumes in the series are due to unfortunate restrictions on space.

In his preface Dr. FULTON states : « The history of science can be written in various ways. It is possible merely to record the development of ideas without reference to the lives of the men who created them... Another mode of writing scientific history, less erudite but possibly more appealing to the beginner, is to weave into the story significant details of the lives of those who have been the chief contributors. It is often the case that the way a man lived and worked is a greater stimulus to those of a later age than what he did... »

« The first chapter is concerned with the classical writers, more particularly with ARISTOTLE and GALEN, and the attempt has been made to describe their methods of work and thought, rather than to enumerate all of the subjects with which they dealt. In treating of the growth of physiology during the sixteenth and seventeenth centuries, when the subject began to develop along varied and rather special channels, it has seemed desirable to follow three main themes : circulation, respiration, and digestion. This has the advantage of preserving the unity of three of the most important subdivisions of physiology and it enables one at the same time to bring in the chief personalities. If the field of the vascular system appears to have been unduly stressed I would explain that this has been done intentionally, since nearly all other branches of physiology had to await the discovery of the circulation before progress could be made. The growth of neurology and neurophysiology, though mentioned, has not been discussed separately... »

Chapter V, *Physiology in the Nineteenth Century : The Rise of the Teaching Laboratories*, briefly treats of BICHAT (1771-1802), MAGENDIE (1783-1855) and J. MÜLLER (1801-1858), and then discusses the Leiden and Edinburgh Schools, the great English School, in which all too briefly

much new material is presented on SHARPEY (1802-1880), QUAIN (1816-1898), and FOSTER (1836-1917), the Continental Schools, and the American School. One cannot help but feel that these sections all deserve just a few more pages so that some discussion might be made of the work of the men mentioned.

Dr. FULTON provides a thought-provoking epilogue : *The Trend of Modern Physiology*. « Physiology has leaned heavily in the past upon the more exact sciences, and prior to the nineteenth century the history of the subject consisted largely of a record of the interpretations of vital phenomena in terms of some newly discovered physical principle. At present, however, physics and chemistry have outdistanced the students of vital function, and it is likely in the future that the bearing upon physiology of discoveries of physicists and chemists will be less immediate than in former times. Unravelling the secrets of living things requires special aptitudes, something beyond the technique of physical science, and Nature imposes severe restrictions upon those who pursue her mysteries. When these are not heeded the thing sought readily eludes their grasp, and the living process often turns without warning into one of disintegration and death... One hopes in the future that physiology will aim to treat the organism as a whole. »

As an appendix, extracts with translations are offered of CLAUDE BERNARD's conception of the term « general physiology », in order to clarify the misunderstandings that seem to be relegating this broad field to the narrow consideration of « the physiological chemistry of substances. »

The bibliography is good. Reference might have been made to W. J. MEEK's stimulating « Beginnings of American Physiology » (*Ann. Med. Hist.*, 10:111, 1928), in which much valuable material may be found. There is a 9 page index of personal names, and an 11 page index of subjects. Space might be saved here by printing in double column. The illustrations are well chosen.

The medical student who desires to obtain an idea of the historical development of the dominating discipline of modern medicine has now three excellent guides, the present volume, Sir MICHAEL FOSTER's « Lectures on the History of Physiology », Cambridge, 1901 and reprinted 1922 (limited to a detailed discussion of physiology from the 16th to 18th Century), and Dr. FULTON's « Selected Readings in the History of Physiology », Springfield, 1930. It is unfortunate that none of these treat of the historical steps in the acquisition of knowledge in such significant phases of physiology as metabolism, secretion, reproduction (these are not indexed in the present volume), the blood, or the senses. There still remains, therefore, in spite of Dr. FULTON's brilliant efforts

(in addition to those noted, mention should be made of his very splendidly organized and illustrated « History of the Physiology of Muscle, » prefacing his « Muscular Contraction and the Reflex Control of Movement, » Baltimore, 1926), ample excuse for the preparation of a real history of physiology. No one is better qualified than Dr. FULTON for such an effort, and let us hope he will make it.

CHAUNCEY D. LEAKE.

Johannes Hoops. — *Reallexikon der germanischen Altertumskunde*, 4 vols., K. J. TRÜBNER, Strassburg 1911-1919.

This encyclopedia, which is extremely valuable for those who are interested in early medieval history, was compiled under the direction of Prof. J. HOOPS of the University of Heidelberg. It contains about 2023 articles, 135 of which are illustrated, most of them written by professors in the universities of Germany, England, Austria, Norway and Sweden. These articles deal with the « culture of the German people from the earliest times to the end of the Old High German, Old Low German, and Old English periods, up to the end of the eleventh century; there are also articles on the culture of the Northmen up to the end of the twelfth century. » Political and theological subjects have not been included.

Practically every author gives the many different spellings of each word found in all the countries and periods under discussion.

For those interested in medieval science there are a great many articles by some of the leading authorities in the different fields. Most of them are brief and merely give the main facts already known on the various subjects and show what further investigations might be carried out.

The discussion of mathematical subjects are by A. A. BJÖRNBO (1874-1911) and R. MEYER and although on the whole rather brief, are good summaries of the state of mathematical knowledge in the early Middle Ages. They are found under such headings as Geometrie, Rechenkunst, Zahlensystem, Grosshundert, Stiege, Brüche, Dezimalsystem, and Duodezimalsystem. With this group might be considered the articles on weights and measures by A. LUSCHIN V. EBENGREUTH. In those on Elle, Andecena, Attunger, Fuss, Jugerum, Juhruota, Idria, Metze, Mutt, Skālapund, Stika, Stouf, Wegemasse, and Zoll, he gives their values in different countries and periods.

The article on astronomy by F. BOLL (1867-1924) is a brief survey of the state of astronomical knowledge, in the early Middle Ages before the appearance of Arabic learning in the Latin West. Quite a number of medieval writers and their works are mentioned, and also their principal classical authorities.

There are several articles on animals, birds, and fish, most of them by J. HOOPS, with a few by F. ROEDER and E. HAHN (1856-1928). In those on the beaver, badger, elk, bear and squirrel, Prof. HOOPS gives brief notices explaining when and under what names these animals were first mentioned in different countries. The domestic animals, such as the dog, sheep, swine, cattle, goat, horse, and cat have been discussed by E. HAHN. He also has two very interesting articles on bee-keeping, and cattle-breeding. Some of the birds and fish known in this period were, the eagle, thrush, daw, pheasant, vulture, duck, goose, hen, eel and perch.

Practically all the articles on trees, plants and fruits are by J. HOOPS, with the exception of a very interesting one, Gemüse, by F. FUHSE in which he gives a list of the vegetables used in the Middle Ages such as beans, peas, cabbages, angelica, kohlrabi, mallow, parsnips, turnips and so on. The articles on barley, peas and millet trace the history of their cultivation and use in the prehistoric period and in the early Middle Ages, giving the different varieties and the places where they were found. There is a fairly long discussion of flax and its cultivation in Egypt and in European countries, and a shorter one dealing with hemp. The trees given in this encyclopedia include the medlar, peach, pear, box, yew, aspen, beech, and oak. In several instances the myths connected with these trees are mentioned, and their use in painting and sculpture. There are also brief notices on berries, nettles, thistles and mushrooms.

The articles on medicine and surgery are all by K. SUDHOFF. Some are on diseases such as small-pox, grippe, measles, and two on the general subject of plagues and contagion, Seuche, and Ansteckung. Others are on various diseases such as quinsy, elephantiasis, epilepsy, jaundice, cancer, tuberculosis, dropsy, erysipelas (St. Anthony's fire), asthma, and leprosy. In his discussions of apothecaries, physicians, and oculists, Prof. SUDHOFF gives a short history of the origin and development of these professions. Under the title Arzneibücher he gives a brief survey of the most important books written on medical subjects between the ninth and eleventh centuries. Medicinal potions are discussed under Arzneitrank, and Betäubungsmittel, the latter being an article on the use of narcotic drinks in operations in Salerno in the eleventh century. There are also articles on the oldest examples of surgery, on the methods used to stop bleeding after an operation, on cupping, and on leeches. Under Arzneipflanzen he mentions a few medicinal herbs, most of his material being taken from the *Hortulus* of WALAFRID STRABO. Other medicinal plants are given by J. HOOPS, such as the poppy, gentian, hen-bane, and aloe. In the article Arzneimittel, Prof. SUDHOFF gives a few early

medieval remedies, some of which are more fully treated under separate headings, for instance under mineral baths, herbal baths, mineral springs, the cold water cure, and therapeutics. A few domus infirmorum are listed under Krankenhäuser.

Some of the most interesting and important articles in the encyclopedia are on agriculture. The two called Agrarverfassung by J. HOOPS, C. v. SCHWERIN, and P. VINOGRADOFF, and Ackerbau by J. HOOPS and V. GUSMUNDSSON, give rather detailed accounts of the methods of agriculture in Roman, early Germanic, English and Norse countries. The second one has four good illustrations. Flurverfassung by v. SCHWERIN is a special article on the cultivation of fields in Northern European countries.

The articles Bergbau, and Bergbau-Technik und Betriebsgeschichte, both a A. ZYCHA, give the main facts concerning the discovery and use of metals in the early Middle Ages. On iron there is a separate discussion of some length by L. BECK (1841-1918), in which he describes the use of iron among the early Germans, and their methods of manufacturing iron weapons and utensils. One of the longest and most detailed articles in the encyclopedia is the one entitled Goldschmiedekunst by T. HAMPE in which he describes the art of the goldsmiths among the early Germanic tribes, and its development in successive reigns, and its condition in various monasteries. There are 16 very valuable illustrations. Prof. H. SCHMIDT has an equally long article with quite a few illustrations on the making of bronze articles. On silver there are two much shorter articles, Silber by A. LUSCHIN v. EBENGREUTH, and Silbergefässe by K. BRUNNER. There is a brief notice on electrum by B. SCHNITTGER, who also has some interesting short articles on enameling, and on semi-precious stones, such as Edelsteinschmuck, Almandinen, and Perlen.

MARY CATHERINE WELBORN.

Margaret Bingham Stillwell. —*Incunabula and Americana*, 1450-1800. A key to bibliographical study. XVIII+483 p. New York, Columbia University Press, 1931. ($ 12).

This book which represents some twenty years of study and experience will prove a godsend to many bibliographers, collectors, and even to professional historians. It deals with two subjects, Incunabula and Americana, which have points of contact, and even cover some common ground, yet are separate. Says Miss STILLWELL : « It may seem odd to treat of incunabula and Americana within a single volume. But, are they not America's heritage in booklore, strongly knit by the bonds of our proudly polyglot origin? Furthermore, there is a precedent in the writings of BAPTISTA FULGOSUS. On June 22, 1509, in his book

De Dictis Factisque, that worthy Doge included a section on GUTENBERG in which he paid high tribute to the inventor of mechanically printed metal letters. On the same page, and directly beneath this eulogy, he placed a paragraph in praise of COLUMBUS—two men of the fifteenth century who, in the everwidening spheres of influence emanating from their achievements, altered the course of history more effectively than anyone since the birth of CHRIST. » (p. IX) This explanation is more specious than convincing, and one might quarrel with the author on that score, but I won't. After all, what does it matter ? : one may consider this book as two, and their union under a single cover is justified by the fact that they have much in common. For example, the method of describing incunabula applies *mutatis mutandis* to every precious book.

Miss STILLWELL's work is divided into three parts. I. Incunabula; II. Americana; III. References.

Part I contains a brief account of the first fifty years of European printing and of the main collections of incunabula. As far as it goes, and within its scope, this is very good, but even the briefest account of that kind should include a summary of our knowledge of early oriental printing. No student of incunabula should be allowed to ignore the Chinese antecedents of our own typography (1). The fact that the two developments (Chinese and European) were apparently independent may perhaps excuse but does not justify his ignorance. This singular lack of continuity is in itself remarkable enough. Moreover an aspect of printing upon which one could not lay too much stress, is neglected by the author : the importance of that invention did not lie so much in the easy multiplication of books as in their standardization. The progress of knowledge depends to a large extent upon the possibility of preserving as purely as possible the results already obtained. The preservation of a text in MS. form was always precarious, since each copy introduced variants of its own. Thanks to printing the risk of variation was enormously diminished : good single copies were replaced by good editions. If a book has been printed in a thousand copies, a thousand scholars can use so-to-say the selfsame book.

The identification and collation of incunabula are very fully and clearly explained. This chapter will be very precious to the tiro, though he will only appreciate the details of it by long practice. It would have been well to warn him that the indications printed in the incunabula may be themselves erroneous. For example the date actually printed in their colophon may be wrong. A good example of such mistakes is given by the author on p. 288, the *Exposicio sancti Jeronimi* bearing

(1) See e.g., my *Introduction*, vol. 1, *sub vocibus :* printed, printing, typography.

the date M.CCCC.LXVIII was probably printed at Oxford ten years later, in 1478 (Such a mistake was easy with Roman figures). Another classical example is the Latin geography of PTOLEMY printed at Bologna in 1472, but bearing the date 1462 (JOSEPH SABIN's *Dictionary*, vol. 16, 47, 1886).

Such niceties are not superfluous even in an elementary book : they serve to remind the student that he must never cease to be on his guard, and take nothing for granted. One might repeat apropos of this the author's wise advice in reference to MS. annotations in printed books : « The attitude of the true bibliographer is always to question and to verify. One might truly say that every clue to a bibliographic source is acceptable and yet none is accepted. That is, none is accepted until in a thorough and complete investigation of every conceivable point, the book in hand and the bibliographic source have been found to agree. » (p. 24).

I often quote to my own students an illustration taken in a different field : one would expect the indications given on a tombstone to be correct; yet errors may occasionally creep in. For example, the epitaph of the great Hungarian scholar, ALEXANDER CSOMA, at Darjeeling in Sikkim (2) contains the sentence : « On his road to H'Lassa to resume his labours he died at this place on the 11th April, 1842, aged 44 years ». Now CSOMA was born in April, 1784, hence he was 58 when he died; one can imagine a traveler having passed through Darjeeling and taken notes, stating : « CSOMA was only 44 years old when he died; I saw it carved on his tombstone ». Yet he would be wrong !

The section on Americana (p. 61-169) was even more interesting to me than the first one, for it contains so much which I do not know, or of which my knowledge is very incomplete. It is in fact a summary of American history from the bibliographic angle. The author was well placed to write it having free access to the John Carter Brown Library of Providence which is perhaps the richest repository of Americana. Not only Americanists but students of the history of geography and cartography will find valuable references in Miss STILLWELL's book. I enjoyed examining the « Tentative table of the introduction of printing into Hispanic America », extending from 1539 (Mexico City) to 1796 (Santiago, Cuba). Many of the earliest imprints are represented by unique or almost unique copies some of which are in the John Carter Brown Library. The list of fifteenth century printing towns (p. 228-247) will be very useful to American collectors; it might have served a second

(2) Preface to Volume Twelve (*Isis*, 12, 5-9, 1929; with portrait.) A photograph of the tombstone may be seen in THEODORE DUKA's biography (154, 1885).

purpose easily by adding to each town name the date when printing began in it.

The reference section covering some 200 p. and listing some 1300 items is very rich and of a very high quality : there are so many explanatory notes that is a truly a « catalogue raisonné » of the subject. It is here that the fruits of experience are most tangible.

The author has the privilege of being the curator of a library of incunabula—the Ann Mary Brown Memorial in Providence, Rhode Island—which is as small as it is rich. While the keepers of very large libraries are encumbered with administrative duties and risk being smothered under an ever increasing load of red tape and stupidity, she enjoys almost the same freedom as a private collector. The present volume proves that she fully deserves her great opportunities. As the use of it and the progress of bibliographical research will suggest corrections and additions let us hope that the demand for new editions will enable her to improve gradually a book which is already of great value. (3)

31.02.08 GEORGE SARTON.

Louis Hourticq. — *La vie des images*. 246 p. in quarto (29 × 23 cm.), 397 illustrations dessinées par l'auteur, 16 pl. Paris, HACHETTE, 1927.

Il est évidemment impossible d'analyser dans *Isis* les ouvrages relatifs à l'histoire et à la philosophie de l'art, mais il est utile d'en étudier un de temps à autre pour empêcher l'historien de la science d'oublier l'importance fondamentale de cet autre domaine voisin du sien. Il est tout à fait indispensable qu'il y pénètre le plus souvent possible, non seulement pour sa délectation et l'embellissement de sa vie, mais aussi pour l'intelligence plus profonde de son propre travail. L'admirable ouvrage de M. HOURTICQ nous donne une nouvelle occasion de le démontrer; mais avant de passer à cette démonstration, décrivons brièvement l'ouvrage lui-même.

C'est une philosophie de l'art dont le grand mérite est d'être extrêmement concrête. L'auteur n'a pas seulement examiné un grand nombre de monuments; il a fait mieux, il en a dessiné des croquis — près de quatre cents — dont il a illustré son livre. Ces croquis sont généralement plus instructifs que des photographies, parce qu'ils sont simplifiés et accentués. L'ouvrage est divisé en dix chapitres, comme suit : 1. La main et la pensée; 2. Image et matière; 3. De la continuité des images; 4. Art et nature; 5. La nature et l'histoire; 6. La légende des pierres; 7. Action des images

(3) With regard to the history of ink, the best work is FRANK BESTOW WIBORG : Printing ink (New York, 1926; *Isis*, 9, 134-38).

sur la croyance; 8. La croyance interprète les formes de l'art; 9. Les images et les mots; 10. L'univers de l'art et celui de la science.

Dans le premier chapitre, et aussi dans le dernier, l'auteur insiste longuement sur l'une de ses idées favorites (qui est aussi l'une des miennes), à savoir, les origines purement techniques et manuelles de la pensée, même la plus abstraite. Ce sont nos mains qui guident notre cerveau; ce sont nos actes qui l'instruisent. Purement accidentels au début, une sélection inconsciente cause la répétition plus fréquente des actes les plus utiles. Comme le dit l'auteur « Sculpteurs et poètes, MICHEL-ANGE et HUGO, nous ont représenté le penseur ramassé sur lui-même, ' son poing puissant sous son menton ', le regard tourné vers le jeu interne, invisible, de la pensée mobile. En réalité, la véritable attitude de l'homme qui ' pense ' est celle de l'ouvrier appliqué sur son outil; il a mesuré des lignes et des figures avant de résoudre des théorèmes de géométrie; il a pratiqué la comptabilité avant de faire de l'arithmétique; il a manié le levier avant de connaître la mécanique, et même ' l'observation ', cette surveillance détachée des faits, n'est vraiment utile que lorsqu'elle équivaut à une intervention où l'œil tient son rôle de ' toucher à distance '; la vision n'est fructueuse que lorsqu'elle se complète par une manipulation imaginaire. » (p. 5). De même dans la transmission des idées, les actes, — ou ces actes figés que sont les œuvres d'art — sont aussi importants que les mots, et dans le passé, avant l'invention de l'imprimerie, ils l'étaient beaucoup plus. Pendant de longs siècles, ce sont des images plutôt que des livres qui ont fourni à l'homme la plus grande partie de son bagage intellectuel. Les images avaient le désavantage d'être imprécises mais elles étaient plus faciles à comprendre, plus persuasives, plus puissantes : elles le sont encore. Les images sont de vraies créations semblables à celles de la nature; elles vivent, se multiplient, nous parlent et nous influencent. « La création plastique nous place à l'une des sources de notre vie spirituelle; elle nous fait assister à une genèse qui commence par un travail manuel et qui s'achève par du sentiment et de la pensée. Ce chef-d'œuvre où l'on s'applique à nous montrer la fleur suprême, le terme d'un long effort, ce phénomène-résultat est en réalité un départ nouveau, le commencement d'une série illimitée. Le travail plastique n'est pas pour l'homme une manière d'enregistrer ses conquêtes, un langage pour exprimer des pensées nées dans un autre domaine. Il est un mode de découverte original, un métier manuel qui est source de spiritualité... » « Tous nos modes de curiosité, tous nos divertissements spirituels, les sciences abstraites ou concrètes et tous les arts, y compris l'art littéraire, sont étroitement mêlés à un procédé technique auquel il; font rendre tout ce qu'il peut donner. La ' pensée pure ' ne se rencontre nulle part; elle est toujours étroitement

associée à l'exercice d'un métier habile. » (p. 229). Comme le remarque l'auteur et comme je l'ai remarqué bien souvent moi-même dans *Isis* et ailleurs, les conditions de la recherche scientifique sont identiques (sauf peut-être pour les parties les plus abstraites des mathématiques), et c'est pourquoi l'histoire des instruments est si importante.

L'étude de la continuité des images (chap. 3) conduit aussi à des idées tout à fait analogues à celles que l'historien de la science dégage de ses propres observations. Il n'est rien de plus frappant dans l'évolution intellectuelle de l'humanité que sa continuité réelle, si ce n'est le manque apparent de continuité; rien de plus frappant que les traditions, si ce ne sont les accrocs infimes qu'y fait constamment l'originalité individuelle. Il n'y a rien de nouveau sous le soleil, sans doute — mais dans un autre sens, tout est nouveau : chaque feuille d'arbre est différente de toutes les autres; chaque enfant qui naît est un prodige de nouveauté. Le rapport qui existe entre l'originalité individuelle et les traditions de l'espèce, nous le retrouvons à chaque pas dans l'histoire de l'art et aussi dans l'histoire de la science.

Les images continuent imperturbablement mais changent de signification au gré des vicissitudes humaines; « les formes artistiques sont comme des vases que les générations se passent pour les emplir de liquides différents » (p. 59). Cependant les formes mêmes évoluent ou plutôt oscillent. Ces oscillations sont plus ou moins rapides à diverses époques ou dans des milieux divers. Pour ce qui concerne la peinture française pendant les trois derniers siècles, l'auteur a trouvé qu'un « style » dure à peu près le temps d'une génération (une trentaine d'années). (1)

Malheureusement, le langage de l'art est beaucoup moins précis que celui des mots, et il en résulte des confusions et des malentendus qui se répercutent ensuite dans d'autres formes de notre activité. L'iconographie des saints nous en donne des exemples piquants. Comment Sainte Barbe, patronne des maçons, est-elle devenue aussi celle des artilleurs? Parce que la tour qu'elle portait ressemblait souvent à un canon. Sainte Catherine d'Alexandrie tenait une sphère, qui devint une petite roue et plus tard la roue fut prise pour un anneau, d'où la légende des fiançailles mystiques avec l'enfant Jésus. Une image de la Madeleine adorant le Christ ressuscité portait le mot « raboni » sortant de sa bouche, d'où l'histoire d'un Saint Raboni « qui rabonnit les maris ». Un Saint Sano du Louvre est devenu une sainte Agnès. Etc.

(1) De 1630 à 1660, ce style est représenté le mieux par POUSSIN; de 1660 à 1690, par LE BRUN; de 1690 à 1720, par LEMOYNE, RIGAUD, et LARGILLIÈRE; de 1725 à 1760, par BOUCHER; de 1760 à 1790, par GREUZE; de 1790 à 1820, par DAVID; de 1820 à 1850, par DELACROIX, DELAROCHE ou DECAMPS; de 1850 à 1880, par COURBET; de 1880 à 1910, par les impressionistes.

L'art est une copie de la réalité, mais ce n'est jamais une copie désintéressée, complète, ni stérile. « Le portrait finit toujours par substituer dans notre mémoire son image à celle du modèle. Chaque fois qu'elle repasse devant nos yeux, une image sculptée ou peinte appuie sur les mêmes traits et superpose exactement une impression nouvelle à une ancienne impression. Quoi d'étonnant, si ensuite nous la reconnaissons dans la réalité? Ainsi, les œuvres de l'art dirigent-elles notre attention et nous conduisent-elles dans le désordre confus de la nature. Elles nous donnent le plan de notre exploration. Apprendre à voir, c'est munir sa mémoire d'images et savoir regarder, c'est reconnaître. » (p. 67). Encore une fois, ne pourrait-on faire des remarques semblables à propos de la science? L'artiste et le savant sont des interprètes; leur points de vue sont fort éloignés mais cela n'affecte point leur fonction essentielle. Tous deux puisent aux mêmes sources, qui sont deux : la nature et l'histoire. J'ai dit cela plusieurs fois en parlant du savant, M. HOURTICQ le répète ici, indépendamment, a propos de l'artiste.

La création artistique, comme la création scientifique, peut paraître désintéressée si on la compare à d'autres activités dont le mercenarisme est plus bas et plus évident, mais elle n'est jamais absolument désintéressée. « On peut bien chercher dans l'art comme dans notre goût de quoi justifier une théorie de la beauté désintéressée, on ne trouve jamais à la source que la forte sève de l'utilité. L'artiste se laisse aller parfois à des exercices de bravoure; il n'y a là qu'un entraînement pour assouplir un instrument et dompter une matière. Les innombrables monuments que les siècles proposent à notre admiration ne font que nous apporter des révélations toujours nouvelles de l'effort innombrable, inlassable de l'homme dans sa lutte pour durer, pour vaincre la mort. L'activité artistique est un des aspects — l'aspect humain — de l'éternel, universel combat qui soutient et mène le monde; la beauté exhale la saine et robuste odeur de la vie. » (p. 227).

Dans le dernier chapitre l'auteur oppose l'activité créatrice et synthétique de l'artiste à l'activité analytique et simplificatrice du savant, mais je ne suis pas d'accord avec lui sur ce point. Analyse et synthèse représentent un des rythmes de la vie humaine dans *tous* les domaines, dans celui de l'art aussi bien que dans celui de la science. L'artiste ne peut créer sans analyser d'abord; et le savant, digne de ce nom, ne se contente pas d'analyser, il reconstruit un monde nouveau — le monde des idées scientifiques — inspiré par la réalité, mais aussi différent d'elle que le monde de l'art.

31.01.12 GEORGE SARTON.